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- Use the new features: Cortana, virtual desktops
- GET WINDOWS 10 ON YOUR PHONE





FULL REVIEW

32-PAGE SUPERGUIDE

ISSUE 242 SEPT 2015 IDG UNITED KINGDOM

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Editor Jim Martin jim_martin@idg.co.uk
Group Managing Editor Marie Brewis marie_brewis@idg.co.uk
Art Director Mandie Johnson mandie_johnson@idg.co.uk
Production Editor Rob Woodcock rob_grant@idg.co.uk
Multimedia Editor Dominik Tomaszewski dominik_tomaszewski@idg.co.uk
Consumer Tech Editor Chris Martin chris_martin@idg.co.uk
Senior Staff Writer Ashleigh Allsopp ashleigh_allsopp@idg.co.uk
Staff Writer Lewis Painter lewis_painter@idg.co.uk
Technical Editor Andrew Harrison reviews@idg.co.uk
Associate Online Editor David Price david_price@idg.co.uk
Associate Editor Karen Haslam karen_haslam@idg.co.uk
Associate Editor Neil Bennett neil_bennett@idg.co.uk
Forum Editor Peter Thomas moderator@idg.co.uk
Editor-In-Chief Matt Egan matt_egan@idg.co.uk
Intern Roberta Alidori roberta_alidori@idg.co.uk

Contributors

Martyn Casserly, Aryeh Klein, Mikael Ricknäs, Agam Shah, Mohamed Wahid

Advertising

Business Director Helen Clifford-Jones helen_clifford-jones@idg.co.uk
Account Director Tom Drummond tom_drummond@idg.co.uk
Account Director Jonathan Busse jonathan_busse@idg.co.uk
Campaign Support Manager Chris Brown chris_brown@idg.co.uk

Marketing

Marketing Manager Ash Patel ash_patel@idg.co.uk
Head of Marketing Design James Walker james_walker@idg.co.uk
Marketing Software Manager Letitia Austin letitia_austin@idg.co.uk
Subscriptions Customer Services pcadvisor@subscription.co.uk

Online

Online Development Manager Adrian Black webmaster@pcadvisor.co.uk
Web Developer Victor Chong **Junior Developer** John Copsey
Web Developer Dominik Koscielak

Accounts

Financial Director Chris Norman chris_norman@idg.co.uk
Credit Controller Dawnette Gordon dawnette_gordon@idg.co.uk
Management Accountant Parit Shah parit_shah@idg.co.uk

Publishing

Publishing Director Simon Jary sj@idg.co.uk
Managing Director Kit Gould kit_gould@idg.co.uk

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IDG UNITED KINGDOM

JIM MARTIN



Windows 10 is here

After all the waiting Microsoft's latest OS has arrived

At last, the countdown is at an end: Windows 10 is here. Whether you're reading this just a few days before it launches or in the days and weeks after, the new operating system represents a big milestone for Microsoft.

Not only does the company need to repair its reputation damaged by Windows 8, it also needs to get businesses on board. It's a milestone, though, because it's the first operating system it's effectively giving away for free. Yes, you'll get Windows 10 when you buy a new PC, laptop or tablet, but upgrades have never been free for users wanting to move to the latest version of Windows on their existing hardware.

As you'd expect, we've dedicated a big chunk of this month's issue to everything Windows 10. As well as our full review – starting on page 50 – we explain everything you need to know about the hardware you need to run Windows 10, which version you're entitled to and the differences between Windows 10 Home and Windows 10 Pro.

We've covered everything from downloading and installing the OS to using its new features including Cortana – the helpful new assistant – plus virtual desktops, the new Edge web browser and how to customise the new Start menu so it's arranged just the way you want it.

You can find out about the features you'll lose by upgrading (page 68) and how to downgrade back to Windows 7 or 8.1 if you decide you prefer your old operating system (page 67). If you're running XP or Vista, there's still a way to upgrade: find out how on page 66.

There's also Windows 10 Mobile, which will launch later this year on phones – you can find out all about it on page 54. If you can't wait, the preview version is available for a wide range of Lumia handsets and we show you how to install it on page 64.

Talking of phones, they're becoming our go-to device for photography and video. So it pays to choose a phone with a great camera that you can use every day as well as on special occasions: holidays, birthdays and weddings, for example. We gathered together nine of the best smartphones around right now to find out how their cameras performed in varying conditions, including selfies. You can see the results starting on page 92.

If you haven't already upgraded your laptop or PC with an SSD, now's the time. We've reviewed six of the best drives on page 82, with capacities up to 1TB and prices starting at just £69 so even if your budget is small, you can still have this super-fast storage that will give any PC a big speed boost. And if you're about to install Windows 10, it really is the ideal time to buy one.

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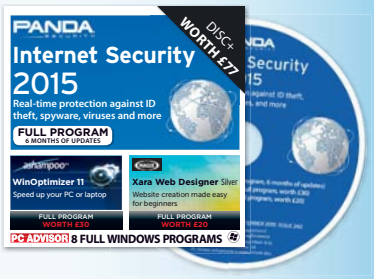
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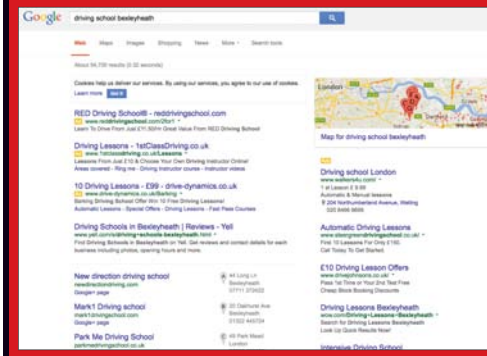
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As Windows 10 launches, Stephen Elop leaves Microsoft

All change at Redmond as former Nokia CEO leaves tech giant for pastures new

Microsoft has shuffled its executive ranks, giving Windows chief Terry Myerson more responsibilities and casting out former Nokia CEO Stephen Elop (pictured). It's been calculated that Microsoft's 14-month 'rent' of former Nokia CEO Stephen Elop cost the firm at least $18 million, or about $1.3 million each month.

The Redmond firm also reduced the number of major engineering divisions from four to three. Two of these existed prior: Cloud and Enterprise (C&E), led by 18-year veteran Scott Guthrie, and Applications and Services (ASG), headed by Qi Lu. Guthrie's group is getting Dynamics, Microsoft's Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP) software, which previously was in its own division.

Terry Myerson, who previously directed the Operating System group, will continue to do that, while also picking up the Devices team, which Elop had run since his return to Microsoft after the $7.9 billion Nokia acquisition finalised last year. Myerson's new group, a mash of his OS team and Elop's Devices division, will be called Windows and Devices Group, or WDG for short.

The creation of Myerson's WDG was a return to how Microsoft organised its engineering efforts immediately after the mid-2012 launch of its Surface and Surface Pro tablets, the company's first-ever personal computer. Then, Julie Larson-Green, who was later shunted to a different role after Elop came aboard, ran the engineering of Microsoft's OSes and its hardware.

"That's a massive group," said Patrick Moorhead, principal analyst at Moor Insights and Strategy, in an interview today. "I think it might almost be too big to manage."

But Rob Helm, an analyst at Directions on Microsoft, saw it differently. "I think this underlines the fact that Microsoft's hardware business is going to be the first and best customer of Windows," he argued.

Moorhead viewed the rearrangement of executives' chairs as a continuation of the massive reorganisation that Ballmer instituted in July 2013. The then-CEO called it "One Microsoft," and touted it as an efficiency move that would make the firm nimbler in a market quickly skewing towards mobile, which Microsoft has largely missed.



Several long-time lieutenants of Ballmer and cofounder Bill Gates before that were put in place to provide advice to Nadella, Helm said. But many of them have since moved on; the removal of others was simply another part of the same process.

Several top-level executives will leave the company in the coming months. These include 25-year veteran Eric Rudder, vice president of advanced technology and education; and Kirill Tatarinov, who had been running Dynamics.

Also out is Mark Penn, the former political advisor who joined Microsoft in 2012. He ran the anti-Google 'Scroggled' campaigns, and was most recently the company's chief insight officer, a role that was never clearly defined. Penn will found a new digital marketing equity firm, Stagwell Group, that has raised $250 million in capital, some of it from Ballmer's billions.

Kurt DelBene, who was pushed out in 2013 by the Ballmer reorganisation but brought back by Nadella in April as the head of corporate strategy and planning, will continue in that role.

Neither Moorhead nor Helm viewed the changes as indicative of a switch in strategies at Microsoft. Nadella's email, in fact, trumpeted the same mantras that have become writ at the company, including "productivity services and platforms" and "mobile-first, cloud first world."

Although Wall Street has often urged Microsoft to divest itself of the Nokia business, there was no clue of such a move in the executive game of musical chairs, said Moorhead. "What will be interesting, though, is who leads the hardware under Myerson," he said. "Microsoft needs a star hardware person. If they do that, then no, [Microsoft won't dump Nokia]. But if they put a long-time software person under Myerson [to head hardware], then maybe."

Earlier this year, Microsoft filed documents with the US Securities and Exchange Commission (SEC) that implied the company would soon take a massive write-off of its Nokia acquisition that could run into the billions.

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Intel's first Skylake chips coming in August

CHRIS MARTIN



Intel announces that its first chips based on the new architecture will arrive in the first week of August

Fancy a Mac or Windows 10 PC with Intel's new processors codenamed Skylake? That will soon be possible: Intel is set to launch its first chips based on the new architecture in the first week of August.

The first Skylake chips will be high-end gaming processors that can be overclocked, and will be launched during the Gamescom conference in Cologne, Germany, which runs from 5 to 9 August, according to a source familiar with the company's plan.

Intel will also shed more technical details about Skylake at its Intel Developer Forum (IDF), due to be held between 18 and 20 August in San Francisco. The chipmaker will talk about how Skylake will improve the experience of using Microsoft's Windows 10.

The first Skylake chips will be branded 'Sixth Generation Core' processors and offer "great performance and reduced power consumption," Intel said on an IDF technical session page. The company's goal with Skylake is to make PC usage more convenient. With that in mind, Intel has talked about 'wire-free' technologies in Skylake, so PCs could charge and transfer data to peripherals wirelessly.

Dell, HP and Asus will ship Windows 10 PCs based on Skylake in the second half of this year. It's not clear when the new chip will reach Apple Macs.

Some Skylake features are already known. Asus recently showed off all-in-ones and mini-desktops based on Skylake, with support for the new DDR4 memory and USB 3.1 data transfer protocol. PCs based on Skylake will also have ports based on Thunderbolt 3, a new technology that runs on USB Type-C cables and can transfer data at 40Gb/s.

One interesting technical session at IDF will detail overclocking the Skylake gaming desktop chips. In other sessions, Intel will demonstrate Skylake PCs running Cortana and Windows Hello, a new Windows 10 biometric feature in which faces, fingerprints or eyes can replace passwords.

Skylake also has new virtualization, boot, system management and lockdown features, which will be detailed in technical sessions.

Intel has hurried to get Skylake to PCs, so it can close the curtains on the troubled predecessor Broadwell chips, which were delayed due to manufacturing issues on the 14-nanometer process.

Skylake will take on AMD's chips – codenamed Carrizo – which are now reaching PCs. AMD is rushing to release its next-gen chips based on a CPU core codenamed Zen, which will be in PCs next year.

AMD aims to revolutionise the gaming industry

AMD focuses on the PC and virtual reality gaming world with new graphic cards

Chipmaker, AMD, has unveiled a new range of graphic cards that aim to revolutionise the gaming industry. This announcement comes off the back of the recent launch of its new graphics processing unit, the Radeon 'Fiji' GPU chip. Prior to this, its last major release in this segment was in October 2013.

This new array of graphic cards, consisting of the Radeon R9 Fury X, R9 390X, R9 390, R9 380, R7 370, and R7 360, all address the demands placed on newer graphic cards.

VR gaming, HD virtual reality, and 4K video are just some of these demands. AMD chief gaming scientist, Richard Huddy, said the products will be sold through the channel, giving these businesses an opportunity to differentiate in a fast-changing graphics card space. "It gives our partners the chance to sell something different, and the channel is keen to have something new. This range changes the type of PC you can build and it's also a place in the market that nothing else competes," he said.

According to Huddy, there are plenty of opportunities for the company's channel partners to build PCs but also to move into the virtual reality space. "It goes beyond traditional gaming methods and there's opportunities beyond the typical demographic. Imagine what virtual reality can do in the education space, for example. You don't have to explain to them the world from the ancient romans to how the pyramids were built; you just have to give them a VR headset and show them."





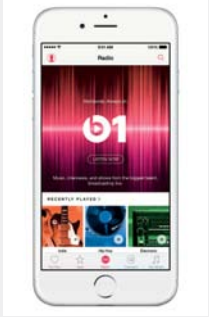
Sky announces Now TV set-top box

Designed for non-Sky customers, mostly those with Freeview, Now TV launched back in 2012 but Sky is pushing on with both a new media streaming box and the best value way of getting Sky Sports on Now TV to date.

Once again based on a Roku-player, the new Sky Now TV Box for 2015 will be available in August and will cost £14.99. The new box includes an ethernet port instead of just Wi-Fi and a processor that is five times faster. Roku said that while it's Roku-powered, the new Now TV Box isn't like-for-like with any of its range of streamers.

There are also changes to the user interface which will supposedly make it easier for customers to find content.

MORE: tinyurl.com/oajorru



Apple Music launches in UK

Apple Music was launched on 30 June in 100 countries as part of the iOS 8.4 update. You'll be able to use it on an Android device when the Apple Music app launches in the autumn. The service will cost £9.99 per month, but the first three months will be free. For £14.99 up to six family members can have their own individual account.

MORE: tinyurl.com/p7526b9

BT set to go 4K this summer

BT Sport goes 4K with Ultra HD channel and YouView set-top box

BT is really taking the fight to Sky when it comes to sport coverage with a new channel dedicated to 4K Ultra HD content and a new 4K set-top box to go with it. John Petter, chief executive of BT Consumer, said: "This is a new chapter for European football on TV. BT Sport will show hundreds of live matches throughout the tournament using the very latest technology. Our presenters and experts will also provide the smartest insight and analysis."

As part of its big announcement for 2015 sports coverage, BT Sport has confirmed it is the 'new home' of European football with 351 matches from the UEFA Champions League and UEFA Europa League. The new BT Sport Europe channel will be the place to catch all the action with Gary Lineker, Jake Humphrey and Rio Ferdinand presenting the live Champions League coverage. New signings include Steven Gerrard, Harry Redknapp, Glenn Hoddle and Howard Webb, plus there will be a new 'Goals' show presented by James Richardson, which will provide news and action across all eight Champions League games as they happens.

There's even more good news as BT Sport announced it will launch a dedicated 4K channel in August called BT Sport Ultra HD. The higher



quality channel will be the first in Europe with The Community Shield scheduled as the first 4K event followed by selected games from the UEFA Champions League, Barclays Premier League, FA Cup and Aviva Premiership Rugby.

BT will also launch a new BT TV Ultra HD set-top box to go with it although there are few details on this at the moment. It will, of course, provide a 4K resolution and come with 1TB of storage. You'll need BT Infinity to watch BT Sport Ultra HD. We'll update this when more info is available but you can register your interest here.

Vodafone offers cheap UK broadband

Vodafone's new broadband service available from £2.50 per month

Vodafone Connect has launched in the UK offering customers cheap UK broadband and home phone services. There are three packages to choose from offering different speeds. Vodafone customers will get a 50 percent discount for the first year meaning broadband will cost just £2.50 per month. The most expensive package will cost £20 per month.

As per usual, line rental is not included in that price and costs £16.99 per month. However, you can save 20 percent by paying a lump sum of £163.10.

Vodafone Connect is available initially to existing mobile customers but will also be offered to non-Vodafone customers later this year. It says the fibre optic network is 'business-grade' and already reaches exchanges which pass nearly 20 million premises across the UK.

The mobile network says its broadband can provide download speeds of up to 76Mb/s. That speed is the fastest, available via the Ultrafast Fibre Broadband package. Superfast Fibre Broadband provides up to 38Mb/s and Broadband ADSL will serve up to 17Mb/s.



As you might expect with a broadband service, Vodafone will provide a free router. Worth £130, it "utilises the latest Wi-Fi technology, allowing priority to be given to a chosen device – supercharging Wi-Fi for seamless video streaming and gaming", the firm says. A Vodafone Connect companion app will allow customers to easily the password, manage users and make use of features such as 'boost' and 'beam'.

Boost lets customers give Wi-Fi priority to a selected device for up to two hours and 'Beam' supposedly focuses the Wi-Fi signal where it is needed for compatible devices.



Saving lives with wearable tech

Rowena Heal reveals how we could be using wearable tech to help the elderly and save lives

For many consumers, wearable tech is still a gimmick, sitting somewhere between the realm of trendy fashion items, kids' toys and fitness accessories.

For years its role focused on the lucrative fitness markets, meaning it has largely missed out on opportunities to offer positives in healthcare and law enforcement. It's no real surprise, as the value of wearable tech in the fitness market alone could exceed $16.1bn this year, but around a third of people buying a wearable product will likely abandon it within six months. Suggesting a new approach is needed to ensure consumers continually use their products.

UK police have been wearable video recording devices for the past 10 years and the New York Police Department have been piloting Google Glass since last year, largely due to an increased need for accountability – highlighting two great examples of extremely positive uses of wearable technology.

Volkswagen recently announced an app for the Apple Watch allowing parents to monitor the driving habits of their teenage children. Car-Net offers automatic incident notifications, roadside assistance and the 'Family Guardian,' which notifies parents when the driver exceeds the speed limit.

The US and Japan have so far led the way on developing and adopting wearable tech in healthcare, aimed at helping chronically ill and older people. In the UK, however, the elderly are only now being properly included in the debate.

Wearable technology has a huge part to play in helping people in later life, but it will be up to developers to capitalise on this and appeal to the older demographic. Panic buttons, wearable emergency call bracelets and neck chains already save lives and are vital for older people living on their own. This technology, however, has been around for a long time and has far-reaching potential; helping the elderly live longer and more independently, a trend often called 'aging in place.'

Auto-dialling panic alarms fitted into the phone, can then by activated by Wi-Fi pendants, which are cheap and useful. A step up is fall-detection systems, that use ceiling mounted optical and acoustic sensors to detect motion in the room. It can then phone an emergency number for assistance and is enhanced by a voice-activated function asking the user how they are feeling. If they respond, the alarm will cancel, so it won't go off if they decide to just take a nap.

For older people, the cost of going into a home can be startling. Residential care for older people costs tens of thousands of pounds each year, and anything that can help them stay in their own home for longer can only be a positive thing.

Wearable technology has a huge part to play in helping them in later life and it will be up to the developers to help capitalise on this and prove it can play a key role in benefiting lives. Whether it's reminding someone to take medication, monitoring their sleep patterns, knee braces with stress sensors or movement recorders, the potential of wearable tech in healthcare is vast. Technology developers clearly want to target lucrative markets and fitness certainly is that, but as the population ages, more people could benefit from a refreshed focus from developers.

HP aims for quick switch to Windows 10 on PCs, tablets

One of HP's first products to get Windows 10 will be the 8in Pro Tablet 608 G1. Agam Shah reports



Acting quickly to move away from Windows 8, HP will start preinstalling Windows 10 across its old and new PCs and tablets within days of the release of the new OS on 29 July.

One of HP's first products with the new operating system will be the 8in Pro Tablet 608 G1, which will ship in July with Windows 8.1 and from August come with Windows 10 preinstalled. Customers buying the tablet in July will be able to upgrade the OS for free. The screen displays images at a 2048x1536-pixel resolution, and its ability to display more content onscreen could make note-taking more convenient.

Other PC makers are also expected to move quickly to preinstall Microsoft's new operating system on their desktops, laptops and tablets. Dell is expected to offer Windows 10 on its PCs from 29 July, while Acer and Lenovo will soon follow.

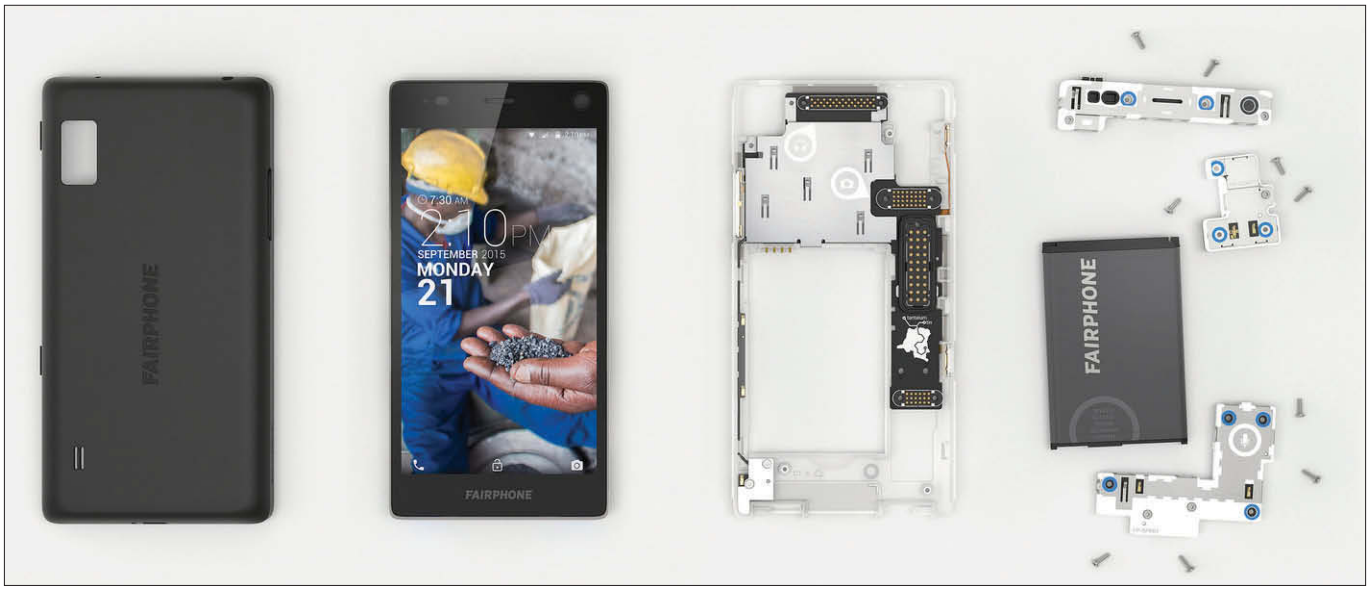
Microsoft is providing free upgrades to Windows 10 from Windows 7 and 8.1 for one year. HP wasn't sure when Windows 10 would be released, so it made sense to keep PCs ready for the new OS, Nash said.

But there's a difference between upgrading to Windows 10 and having the new OS preinstalled, particularly on PCs. Upgraded systems will have Windows 10 as the default OS, but they will still have Windows 8.1 as the recovery operating system. PCs with Windows 10 preinstalled won't have a trace of Windows 8.

HP has worked closely with Microsoft on building drivers, user interfaces and BIOS-related features related to Windows 10, explained Nash.

The PC maker is particularly keen on bringing Windows 10 to its hybrids as the new operating system is better at adapting to different PC usage models. Hybrids running the OS will be able to automatically switch between tablet and desktop interfaces, based on a device's position. It's also more sophisticated at analysing sensor data, which helps identify whether the device is in laptop or tablet mode.

With the 608 G1, HP sees potential advantages from packaging Intel's new Atom chips code-named Cherry Trail with the new OS. The chips provide faster application and graphics performance than previous Atom chips. The tablet is 8.35mm thick and has a USB Type-C port for charging and data transfers. It has a 2Mp front and 8Mp rear camera, and up to 128GB of storage.



Photography by Fairphone

Meet Fairphone 2: the socially responsible smartphone

Mikael Ricknäs reports on the Fairphone 2: Fairphone's second-generation socially responsible smartphone that will start shipping later this year

Fairphone, the Dutch company that aims to sell socially responsible smartphones, is working on a second model that can be repaired with little hassle and won't easily break. The company is also sticking with its goal of using conflict-free or fair trade minerals.

One of the company's key aims with the Fairphone 2 was to extend the longevity of the product. Making it easy to repair is part of that. For example, it will be possible to replace the display on the Fairphone 2 in less than a minute, the company promises. After removing the case and battery, the two clips that lock the display in place are slid towards each other, and then the entire unit can be taken out, CTO Olivier Hebert said in a blog post on Tuesday.

The receiver, rear camera and speaker units can be repaired with the help of a screwdriver. To guide users, each unit is connected to the chassis with a set of colour-coded screws. Fairphone is betting that buyers will sacrifice slimness for a smartphone that's easier to repair. The result is a phone that's 11mm thick.

The hardware architecture also opens the door for future upgrades. All of the individual components can be replaced, provided they fit within the design of the original unit and can use the existing electrical interfaces. However, software complexities need to be addressed for upgrades to be possible, Hebert said without delving into the details.

A second goal was to build a device that doesn't easily break. Most current smartphones are simply too fragile, according to Hebert. The Fairphone 2, on the other hand, should survive a drop of about 2m on to concrete. The robustness is in part possible thanks to a rubber rim that wraps around the screen. Fairphone decided against making the phone completely sealed to keep out water and dust, as doing that conflicted with other design goals, especially the ability to open and repair the device.

The aim is still to manufacture a smartphone that doesn't use minerals from conflict zones, is recyclable, and is made by workers who are treated well. The Fairphone 2 will be available for preorder before the end of August, and then ship during the following couple of months, the company said. Pricing wasn't announced.

Hardware specs include a Qualcomm Snapdragon 801 processor and a 5in, Full HD screen. The camera has an 8Mp resolution and there is 32GB of storage that can be expanded using a microSD card. The LTE smartphone also has 2GB of RAM and two SIM slots. The OS will be Android 5.1.

The first model, of which Fairphone sold 60,000, scored 7 out of 10 for repairability in a teardown test by repair website iFixit. Positives included that it's easy to open up the device and access the components. However, the glass is fused to both the display and the display frame, which increases repair costs – a mistake that Fairphone has learned from.

In general, today's high-end smartphones are a mixed bag when it comes to ease of repair. Apple has a reputation for building products that are difficult to fix, but the iPhone 6 and 6 Plus both got a 7 out of 10 score on iFixit. The company still uses proprietary Pentalobe screws, and it doesn't share repair information with independent repair shops or consumers. But the display assembly comes out easily and the battery is easy to access.

For people who want a high-end Android smartphone that's easily repaired, the G4 from LG is a good option. It was awarded an impressive 8 out of 10. The only drawback is that the glass and LCD will need to be replaced together if one or the other breaks.

Two other top-of-the-range smartphones, the Galaxy S6 from Samsung Electronics and HTC's One M9, didn't fair as well, scoring 4 and 2 out of 10, respectively. Strong adhesive on the rear glass makes it very difficult to gain entry to the S6's innards. On the One M9 adhesives make many components difficult, and even dangerous, to remove and replace, iFixit said.

Sony wants to bring 4K video capabilities to more digital cameras

Sony has a new Exmor sensor chip that will bring 4K to more of its cameras Agam Shah reports

Sony has revealed an ambitious plan to bring 4K video-shooting capabilities to a wide range of its point-and-shoot and SLR cameras over time, and a new sensor developed by the company will help make that possible.

The Japanese firm introduced its first three digital cameras capable of shooting 4K video at a recent press event in New York. The cameras are based on a new Exmor sensor, which can shoot highly sensitive images at up to 42.4Mp.

The sensor, a big improvement over its predecessors, gives Sony the basic capability to bring 4K video to all its point-and-shoot cameras over time, revealed Daisuke Goh, product planner at Sony.

Two of the new cameras introduced were new Cybershot models, which are targeted at consumers. It's hard to predict when other pocket-fitting Cybershots will get 4K video, but according to Goh, Sony's goal is to bring 4K video recording capabilities to more cameras as soon as possible.

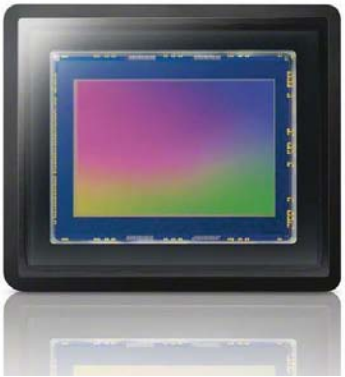
The Japanese tech giant wants to move quickly to 4K across its product lines, and wants to tie the functionality of its digital cameras closer to its TVs, Goh added.

The company already offers video cameras capable of shooting 4K movies, but its stills cameras mostly capture film at resolutions of up to 1080p. But by moving to 4K, Sony is taking a step to increase demand for its digital cameras. Digital camera shipments have declined in recent years, with smartphones and tablets being used to take more pictures and videos.



SONY CYBERSHOT RX10

The cameras introduced in New York are capable of shooting 4K video at high framerates, which the company's Xperia phones are not capable of yet. The new Exmor sensor makes major advances in technology, with the ability to capture light more effectively, which helps deliver picture readouts faster. The sensors can also capture more detail, and stacked DRAM chips are capable of buffering images temporarily, which helps effectively capture slow-motion video. The new cameras also boast improvements in image stabilisation, ISO and shutter speeds.



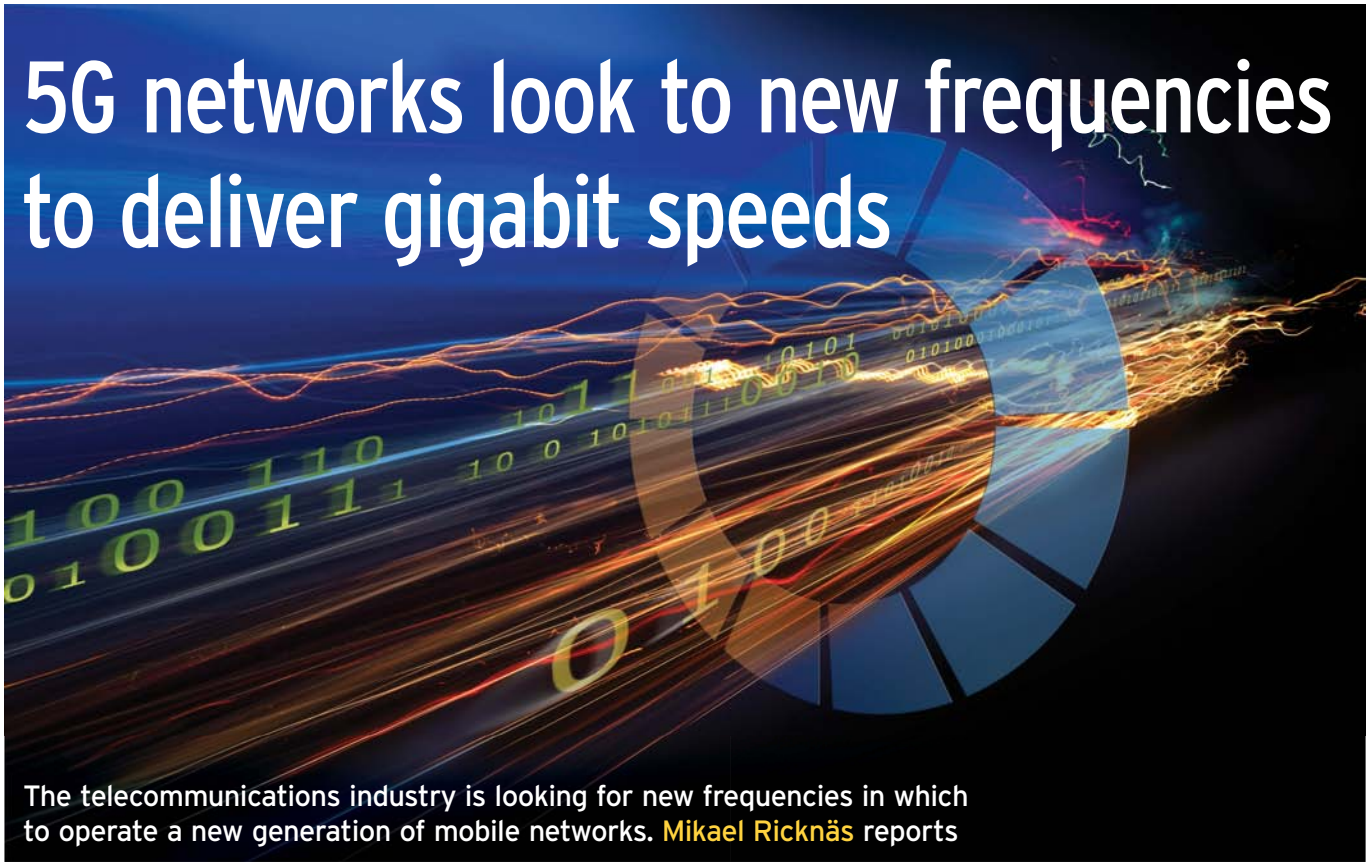


EXMOR SENSOR

The more advanced Exmor R sensor is in the Alpha 7 R II camera, which can capture more detailed images and can render pictures 3.5 times faster than its predecessor. With a new Bionz X image processing engine, the SLR camera can fine-tune images to look more natural. The camera can record 4K movies in full-frame format, and captures 1.8 times as many pixels as required for 4K movies.

The new Cybershot cameras are not as advanced as the SLR model. The 20.2Mp Cybershot RX10 II and 20.1Mp RX100 IV have the Exmor RS sensor, which is a modified version of the Exmor R sensor, but for lower-resolution cameras. The RX10 II can shoot up to 29 minutes of 4K video in one session, while the RX100 IV can capture up to five minutes. The cameras are designed to capture slow-motion video, and the sensors can capture high-frame-rate 4K video at 960 frames per second.

5G networks look to new frequencies to deliver gigabit speeds



The telecommunications industry is looking for new frequencies in which to operate a new generation of mobile networks. Mikael Ricknäs reports

If operators are to build 5G mobile networks with download speeds at 10Gb/s and above, they are going to need a lot more spectrum, but getting it won't be easy.

The amount of spectrum allocated to 5G will determine how fast networks based on the technology will eventually become. Until recently, only frequencies below 6GHz have been considered for mobile networks, mostly because they are good for covering large areas. But there's now a growing need to unlock new spectrum bands in the 6- to 100GHz range too, attendees at the recent LTE and 5G World Summit conferences in Amsterdam heard.

The use of spectrum in these bands is immensely important for 5G networks to be able to offer multiple gigabits per second, Robert DiFazio, chief engineer at wireless R&D company InterDigital Communications, said. By raising communication speeds, they are also expected to help lower latency in mobile networks.

Even though spectrum from 6- to 100GHz won't be used in cellular access networks for at least another five years, vendors are keen to show they can handle all the technical challenges those frequencies present. The development of WiGig, which uses the 60GHz band, has already showed that using such high frequencies works, and on the show floor in Amsterdam, Huawei Technologies and Samsung Electronics both talked up pilot studies of other technologies they have conducted.

For the potential of spectrum above 6GHz to be realised, a new generation of antennas will be required, capable of directing multiple beams of data to different users at the same time. New systems will likely also need new modulation schemes to encode the data on the radio waves more efficiently.

There are ways for mobile networks to increase download speeds using existing spectrum, including using carrier aggregation or sharing spectrum with Wi-Fi networks. But at the end of the day, none of these options come close to the potential that as-yet-unused frequency bands above 6GHz offer. There is nowhere else to go but up, according to Samsung.

Rolling out networks isn't just about hardware and software, according to regulators. "We have made clear our intention to make large quantities of spectrum available in these frequencies, which is increasingly also the view of other regulators around the world," said Andrew Hudson, director of spectrum policy at British regulator Ofcom, who spoke on the subject at the Amsterdam conference.

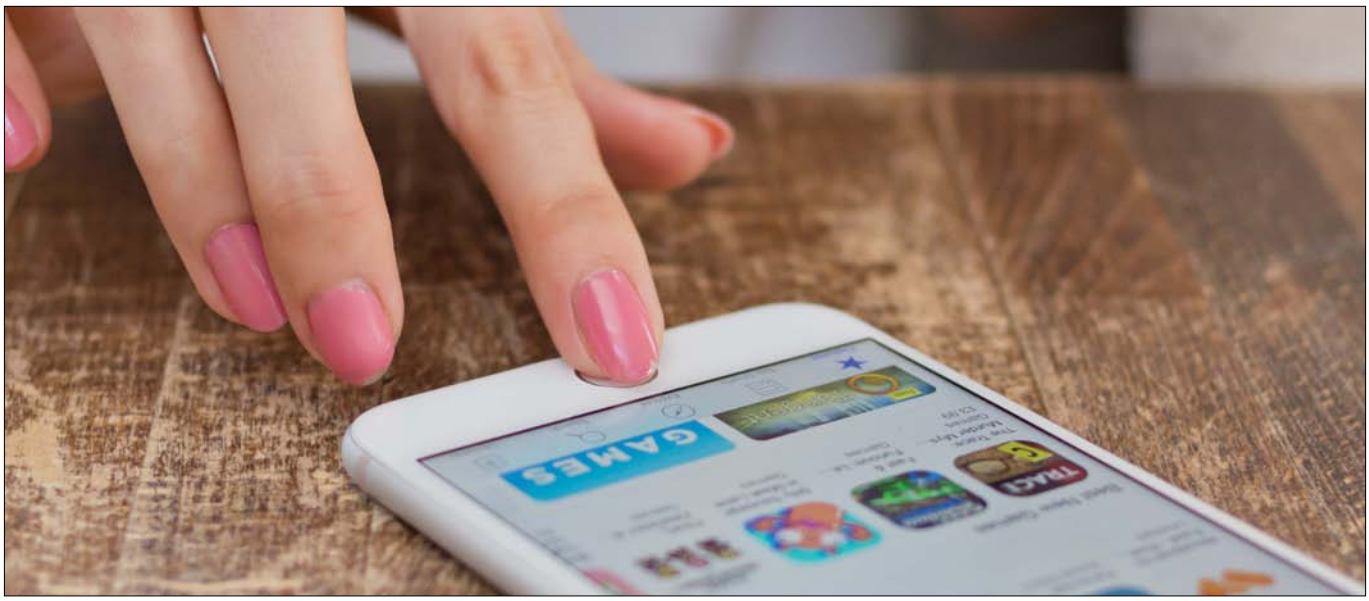
The current focus of Ofcom's work isn't whether to make spectrum available, but how to identify the best spectrum in this range. This involves finding bands with a combination of good physical characteristics and good prospects for international harmonization, while taking into account current use, according to Hudson.

A final decision on what – if any – bands will be allocated isn't expected until 2019.

After technical and regulatory challenges have been overcome, the networks also have to be rolled out. If extreme speeds are the upside of frequencies over 6GHz, poor coverage is the downside. These high frequencies don't have good reach and aren't very much use if you want to penetrate walls. To get around these weaknesses, mobile operators will have to install lots of smaller base stations, but finding enough places to put even the current generation of small-cell base stations has already proved difficult.

So taking full advantage of spectrum bands above 6GHz won't be easy, but if equipment and device vendors want 5G to become something more than an incremental upgrade over the LTE networks that exist in 2020, all technical and political challenges have to be overcome.

The first commercial networks using 5G technologies are expected to go live in 2020, but will initially use spectrum below 6GHz because the infrastructure is already out there for those bands, according to DeFazio: Networks using the new frequency bands will only arrive later.



Fingerprint sensors on their way to more smartphones

Cheaper sensors and broader software support will make fingerprint authentication more accessible to app developers and service providers, reveals Mikael Ricknäs

Fingerprint authentication will become a lot more common on smartphones of all prices as sensors get cheaper, and Google's integration of the technology in the next version of Android will make it much easier for app developers and service providers to make use of them.

Today, fingerprint sensors are mainly available on high-end models from Apple and Samsung Electronics. But that is about to change, according to sensor manufacturers Synaptics and Fingerprint Cards.

The latter has seen a growing interest in its technology from smartphone manufacturers in recent months, as well as a strong increase in orders. As a result, the company has raised its revenue estimate for the year from about 1.5bn- (£115m) to 2.2bn Swedish Krona (£191m).

"This market is really starting to take off," said Jürgen Lantto, CEO at Fingerprint Cards, who anticipates that half of all smartphones sold next year will have the feature.

Fingerprint Cards sensors are already used in the Ascend Mate 7 from Huawei Technologies and Oppo's R7 Plus, which was launched in May. Synaptics, which makes the sensor in the Samsung Galaxy S6 and S6 Edge, is equally sure that smartphones with fingerprint sensors will become more popular.

"The market is hot, and the adoption rate across a broader range of products will grow faster now," said Anthony Gioeli, vice president of marketing for Synaptics biometrics business unit.

Google adding native support for fingerprint sensors in Android M is a major reason why the technology has started to take off on a larger scale. The native support will make it easier for smartphone manufacturers to integrate fingerprint sensors in their devices. It will also make life easier for developers, who can use Android APIs to integrate fingerprint recognition in their apps instead proprietary ones developed by the sensor makers, Lantto said.

Developments on the hardware side are also lowering the bar for fingerprint recognition. Prices have come down by about 25 percent in the past year, and they will continue to drop as volumes increase, Gioeli said. It's already possible to build a £75 smartphone with fingerprint recognition, according to Lantto.

The launch of the iPhone 5s with Touch ID proved to be a blessing and a curse, at least a short-term one. On the plus side, it helped increased awareness. But many competing smartphone vendors wanted a touch sensor, just like Apple had got from its 2012 acquisition of AuthenTec, instead of the swipe sensors Fingerprint Cards and Synaptics had developed. It took six- to nine months to regroup, Lantto said.

Beyond Apple and Samsung, many Chinese vendors have been adding fingerprint sensors to their smartphones. Huawei will certainly offer it in more future models, according to a spokesman at the company. Using fingerprints as opposed to PINs or patterns has proved ideal for heavy smartphone users, he said. Fingerprint Cards has recently added Yulong and Gionee to its list of customers.

Many of the more established vendors, such as LG Electronics and Sony, are still on the fence. HTC recently launched the One M9+ for the Chinese market.

Mobile payments will also likely help fuel the availability of fingerprint recognition on more devices. If Google wants its upcoming Android Pay service to take off, it needs to convince more vendors to integrate the technology. Allowing Google to offer the same functionality as Apple Pay. Just adding fingerprint recognition to this year's Nexus smartphones won't be enough. The same goes for Samsung. If the company wants Samsung Pay to be successful, more devices than the Galaxy S and Note products will need to be equipped with the technology. ☒

Life gets tougher for alternative mobile OSes Tizen, Firefox and Ubuntu

An increased focus on affordable smartphones running Android has left smaller operating systems behind. Mikael Ricknäs reports



SAMSUNG TIZEN-BASED Z1

The future doesn't look very bright right now for alternative mobile operating systems Firefox OS, Tizen and Ubuntu.

It's always been difficult to attract developers to these platforms, and now smartphones powered by the OSes are also falling behind affordable Android devices on hardware specs. So not only must their users put up with a smaller selection of apps, but also with less powerful devices.

Struggling to compete with Apple in the high-end of the smartphone market, the Android camp has increasingly turned its attention to mid-range and low-end products. While this has been good for consumers looking for more affordable products, it has turned up the competitive heat on Firefox OS, Tizen and Ubuntu.

Case in point: Samsung Electronics' Tizen-based Z1, which after many delays premiered this year in India, a country with a low smartphone penetration. But others also saw the opportunity, and today competition in India and many other developing countries is even more heated than in Europe and the US.

The Z1 has a 1.2GHz dual-core processor and a 4in, 480x800-pixel screen. There is a 3Mp camera on the back and a VGA camera on the front. The price tag in India is now about 5,000 rupees (£51).

For the same money, the new Honor Bee from Huawei Technologies has a 1.2GHz quad-core and a 4.5in, 480x854-pixel screen. The main camera has an 8Mp resolution and there is a 2Mp for selfies. The Bee, which runs Android, has twice the storage at 8GB. Consumers willing to spend another £30 on a more advanced model get a bigger HD screen and LTE.

Firefox OS smartphones are also struggling to compete. Japanese mobile operator KDDI and LG Electronics have developed the FxO, a Firefox OS-based phone with a 4.7in HD screen and LTE. But it costs Y49,680 (£266), while Android-based smartphones in the same price range in Japan offer bigger full-HD screens, faster processors and more storage.

There are signs that at least Firefox OS developer Mozilla Foundation and Ubuntu developer Canonical are trying to step up hardware efforts.

Mozilla is working to ensure future Firefox OS smartphones meet or exceed expectations in terms of performance and reliability, at all price points, CEO Chris Beard said in a recent email to the community. As part of this reboot, Mozilla CTO Andreas Gal, who co-created Firefox OS and wrote the first lines of code, is leaving Mozilla this week. The push to build £25 smartphones hasn't been as successful as the organization had hoped. The lesson is that Firefox OS phones have to offer something more than just a low price.

Meanwhile, Canonical is working with Spanish hardware maker BQ on a high-end Ubuntu-based smartphone designed to double as a PC when connected to an external screen and keyboard, according to Cristian Parrino, vice president of Mobile and Online Services at Canonical.

It will also be the first Ubuntu device that's not based on a previously released Android smartphone. "For once we'd like to come out with a device at the same time as it comes out on Android," Parrino said.

For example, BQ launched recently its second device running Canonical's OS, the €200 (£143) Aquaris E5 HD Ubuntu Edition, whose Android edition started shipping last year. The smartphone has a 5in HD screen, a 13Mp rear camera and a 5Mp front camera. While the launch is a step in the right direction, the smartphone lacks LTE and features a low-end quad-core 1.3GHz Cortex-A7 processor from MediaTek.

One development that would help all the OSes is wider support from smartphone manufacturers, but up and coming vendors such as Xiaomi and India's Micromax Informatics have showed little interest in the newcomers, preferring Android instead.

Xiaomi has its own MIUI user interface and Micromax is collaborating with Cyanogen. The alternative operating systems don't have enough scale. When even Microsoft is struggling to compete, it's hard to see how the smaller platforms can make a difference, Micromax chairman Sanjay Kapoor said in an interview earlier this year.

To help with growth, Samsung has installed Tizen on smartwatches and TVs. The latter is a product category Mozilla is going after, as well. Panasonic has started rolling out its first Firefox OS Viera TVs. Success won't come easier in these two sectors, but it could help raise the profile of the two operating systems.

Still, with a combined market share of less than 0.4 percent, all three operating systems face an uphill battle, and if they disappear, it would be a loss for consumers, because it would mean less competitive pressure for Apple and Google.

GSM switch off good news for phone users, not for connected devices



Asian and US operators are more aggressive than their European counterparts. Mikael Ricknäs reports

Carriers around the world are converging on 2017 as the year to turn off their GSM networks, with three operators in Singapore announcing Monday their plans to reuse their GSM spectrum for other services.

The end of GSM will free up more bandwidth for faster 3G and 4G network technologies – but will also force users of older connected devices that depend on GSM networks to upgrade or replace them.

On Monday Singaporean operators M1, Singtel and StarHub became the latest operators to set a timetable for turning off their GSM networks. They will do so on April 1, 2017, following in the footsteps of Telstra in Australia, which plans to do so by the end of 2016, and AT&T in the US, which will flip the switch on 1 January 2017.

For many mobile users, the switch-off could pass almost unnoticed. Today, the majority of mobile customers have phones that also connect to 3G and 4G networks; only a small percentage of subscribers still use GSM-only phones, according to the Singaporean operators. When Telstra made its announcement last year, it said GSM accounted for less than 1 percent of traffic.

The reasons for turning off GSM networks are technical and financial. Turning them off means the spectrum can be reused by more efficient 3G and 4G networks, which can use the same bandwidth to carry more data or serve more customers – and hence generate more revenue. Having one less network to manage should also result in lower costs for operators.

The rapid pace of phone replacement means most phones in use are ready for the switch to 3G or 4G – but that's not the case for many connected devices, which tend to have far longer working lives. Because of its low cost and good coverage, GSM is a popular option for so-called machine-to-machine (M2M) connections used to link vehicles, alarms, vending machines and a host of other connected devices. There were about 160 million of them by the end of last year, according to Machina Research. A new generation of chipsets is laying the groundwork for cheaper LTE modems for such applications, but the majority of M2M devices shipping today rely on GSM, Machina Research CEO Matt Hatton explained.

Upgrading the network will be worth it, though, according to AT&T. The higher speeds offered by 3G and 4G networks will enable enterprises to deliver better M2M applications. For example, video cameras for real-time streaming and driver dash cameras for fleet trucks will be possible.

Not all operators are as aggressive in their plans to turn off GSM. In general, European operators are being a bit more cautious. For French network operator Orange, there will no big switch off, according to Yves Bellego, director of Technical and Network Strategy at the French operator. Norwegian operator Telenor plans to turn off its 3G network in 2020, and its GSM network in 2025, it recently announced.

The reticence to make the move isn't just down to wanting to support existing M2M devices. The European operators still have lucrative roaming businesses and could run into some regulatory issues if they decide to turn off GSM networks in the next couple of years, according to Hatton.



Why Formula-e needs to go faster

Petrolhead Jim Martin enjoyed switching to battery-powered racing. But the tech needs to improve

Recently something new and never seen before happened in central London: 10 motorsport teams descended on Battersea Park as it was converted from a place of tranquillity into a racing circuit.

Strangely enough, it was the eclectic mix of jazz and dance music pumping from the trackside PA system that broke the silence, rather than the cars. Because, you see, this is Formula-e.

E stands for – you guessed it – electric. The series is all about promoting the sustainability of zero-emission vehicles to the watching public and the cars emit little more than a high-pitched whine as they scamper around narrow street circuits.

The London E-prix was the final event (two events, in fact) of a long season that began way back in September 2014 in Beijing. There's just one event per month, which means fans have had to be patient between races. However, Formula-e needs to up its game if it's to convince people of the benefits of EVs and to win a bigger audience.

The main problem, one among many, is speed. While the identical Renault cars are capable of up to 140mph, they just don't look that quick on track. Even less so on TV than up close in the flesh.

Plus, they sound like a group of radio-controlled cars being played with by kids in a car park. It will take longer for petrolheads to come around than it has for the switch from V8s to V6 turbos in F1. Formula-e bosses might prefer to build a new audience and avoid comparisons with F1, but given the number of ex-F1 racers in the series as well as some of the teams, it's unavoidable.

Formula-e races lack the excitement you get from other racing series, caused by a variety of factors. The lack of speed is partly due to the nature of the narrow street – or park – tracks, but also because drivers have to conserve battery power.

Why Formula-e needs to go faster

It's particularly odd that the decision was taken to make races twice as long as batteries can last. This doesn't paint electric cars in the best light: a lack of range is still one of their biggest limitations. Drivers have to pit around lap 15 and jump into a second, fully charged car. (For safety reasons, there's a minimum pit-stop time meaning there's none of the frantic action you get in F1.)

It would have made more sense – to me at least – to have two shorter sprint races where battery power isn't such a worry. The car could then be recharged between races.

Don't get me wrong. I thoroughly enjoyed my day at Battersea Park watching the race, meeting some of the drivers and getting up close to the cars in the pitlane. It may also have been more easily accessible – to me – than Silvestone, but it wasn't as exhilarating or spectacular as being at the British Grand Prix (even the practice).

This, though, is just the start for Formula-e. As battery technology improves, it will be interesting to see whether the two-car dance is retained or race distances are increased. I can imagine some will prefer the former in order to see drivers using the maximum speed and performance of the car without holding back to save energy.

Whatever happens, I hope Formula-e can prove beneficial to the development of the electric cars we'll all be driving in a few years' time. There are flashes of brilliance in the Tesla and BMW i8, but until batteries don't degrade to the point their range is close to useless, and prices come down, I for one won't be making the switch.

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8.1 Windows Microsoft



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8.1 Windows Microsoft



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8.1 Windows Microsoft



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8.1 Windows Microsoft

Scan Computers recommends Windows.

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Microsoft Xbox One 1TB

Games console

The new model of Microsoft's Xbox One has a 1TB hard drive, meaning extra storage for games and media. You can also plug in a USB 3.0 external drive for even more space, and the new controller has a 3.5mm headphone jack.

£349 inc VAT
xbox.com





Nest Cam

Security camera

Following on from the smart thermostat, the Google-owned company has announced the Nest Cam. The security camera features Full HD video quality and you can live stream to your smartphone or PC. The down side is that you'll need to pay £8 per month to record 10 days' worth of video to the cloud.

£159 inc VAT
nest.com/uk

PNY Elite Performance microSD

Memory card

If you have a camera such as the 4GEE Action Cam (page 22), you'll need a memory card to store your movies. PNY's latest microSD card is designed especially for this purpose, with 100MB/s transfer rates and shock and humidity resistance. As usual, they come in a range of capacities and include a size adaptor

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GAMING LAPTOP

Schenker XMG P505

£1,822 inc VAT

Contact
■ mysn.co.uk

Specifications
15.6in (2880x1620, 212ppi) IPS matt anti-glare; Windows 8.1; 2.6GHz Intel Core i7-4720HQ (3.6GHz Turbo) 4C, 8T; nVidia GeForce GTX 980M with 4GB GDDR5 and Intel HD Graphics 4600; 16GB (2x 8GB) 1866MHz DDR3; gigabit ethernet; 802.11ac 2x2 MIMO; Bluetooth 4.0; 3x USB 3.0, 1x eSATA/USB 3.0; 2x Mini DisplayPort 1.2, HDMI 1.4; Kensington lock slot; SD, SIM card slots; stereo speakers; webcam, array microphone; 3.5mm headphone jack, 3.5mm line in, 3.5mm S/PDIF; 60Wh lithium-ion, non-removable battery; 180W mains charger with IEC C13 inlet; 385x273x29.5mm; 2591g

Build: ★★★½☆
Features: ★★★★½
Performance: ★★★★½
Value: ★★★½☆

★★★★☆

XMG is the gaming sub-brand of German laptop maker Schenker. And within the XMG range lies a choice of three levels – Advanced, Core and Pro – which correspond to the entry-level, midrange and flagship series.

So the XMG P505 is a gaming laptop from the top tier that Schenker says can deliver – unless you want to step up to the Ultimate Series. This takes a desktop-class CPU and all the trimmings, making it more of a fire-breathing desktop-replacement PC; less of a notebook you'd want to place upon your lap.

This 15in gaming laptop serves as a platform to host nVidia's newest 900 Series mobile graphics processors, namely the GeForce GTX 965M, 970M and 980M. We tested a configuration with the top 980M, allied with the laptop motherboard's single choice of CPU, an Intel Core i7-4720HQ running at 2.6GHz. This chip packs 6MB cache and can Turbo up to 3.6GHz.

Configurations and options

The starting price for the XMG P505 is £891, although at this price you don't get any internal storage, let alone an operating system to install it on, nor any wireless connectivity. Visit the laptop's product page and you'll find that Schenker UK has a base model with a 500GB hard disk and budget 11ac Wi-Fi card for a price of £939, although you'll still need to pay £65 for Windows.

Memory is fully configurable, from a single 4GB RAM card of Crucial Ballistix Sport, up to 32GB Kingston HyperX Impact. The given options are for 1866MHz clock memory, higher than Intel's official specification for this processor of 1600MHz. Schenker UK tells us that even higher-clocked RAM can be used, up to 2133MHz, although this isn't stable.

We specified 16GB of Crucial memory. There's a total of four slots for SO-DIMM memory modules, with the preinstalled RAM positioned on the reverse side of the motherboard. There's a way in through the keyboard, to swap this out without a lengthy teardown of the entire machine. You can also add two more memory cards easily to slots on the top side of the motherboard when the bottom plate is removed.



The standard 15.6in screen is 1920x1080 resolution, IPS technology, and finished with a matt anti-glare coating. You can also trade up to a 4K UHD panel of 3840x2160, although since even the world's finest GPUs for laptops struggle at four-times the full-HD resolution, we suggested a 2880x1620-pixel panel as the best compromise, driven by the top GTX 980M graphics processor with 4GB of GDDR5 video memory.

Storage options get very interesting, as the P505 can accept up to two traditional SATA drives, either 2.5in hard disk or SSD up to 9.5mm thick each, plus two M.2 form-factor drives. One of the latter can be a PCIe-attached flash drive, using four lanes of PCIe 2.0, while the other is fixed to a SATA bus only. But this SATA-only M.2 card slot can also potentially take a cellular data modem, which is why chassis manufacturer Clevo includes a SIM-card slot on the laptop's side. Our sample was configured with a single drive, a Samsung XP941 PCI3 2.0 x4 card with 512GB capacity.

For wireless communications, we added the option for Qualcomm Killer dual-stream 802.11ac. Despite the size of the laptop, there's no third antenna in the chassis to allow a full 3x3 MIMO Wi-Fi card.

Build and design

Like most customisable laptop designs, Schenker relies on pre-built and semi-stuffed chassis from Taiwan maker Clevo, and here the XMG P505 is using a Clevo P651G case and display assembly.

This case is a heavy-duty chunky construction, satin finish black comprising an aluminium lid back and top deck area, and a black plastic bottom on the model we tested. Ironically, if you choose the cheapest nVidia GTX 965M graphics, you should get a metal bottom plate, too. The plastic bottom is reserved for models with GTX 970M and 980M, which require a more powerful cooling system. Cooling is undertaken by three fans, two on the GPU and one for CPU.

There's no built-in optical drive, and like many modern laptops the battery is not designed to be changeable by the user. Inside is a lithium-ion battery pack with 60Wh energy capacity. In our standard video-rundown test, this let the P505 survive off the mains for three hours 11 minutes.

The laptop weighs a not ungainly 2.59kg in this configuration, but you'll need to factor in another 1.05kg for the 180W mains power supply should you need to travel far.

The keyboard, trackpad and display are all of a very high quality, with special mention for the unusually precise trackpad with its two real buttons, and the first-class IPS display on the model we tested.

Ports and components

With such a capable graphics processor under the bonnet you may be inclined to connect additional display, made easy by the choice of two Mini DisplayPort v1.2, which can channel up to 3840x2160 pixels at 60Hz; and an HDMI 1.4 port good for 2560x1600 (or higher to 4K UHD but with slow refresh rate).

Three USB 3.0 ports are joined by a fourth on the backplane that doubles as an eSATA port. For audio there are three 3.5mm jack sockets, designed for S/PDIF, mic input and headphone output. Sound quality from the built-in stereo speakers with 2W amplifier is perfunctory, but sufficient for lo-fi music playback.

Performance

The Core i7-4720HQ is a popular choice for gaming laptops at the moment – four out of six machines in our last group test all used the same Intel chip. Our benchmark results for the P505 followed the scores from those laptops, returning 3545 points in Geekbench 3, and 13,336 with eight Hyper Threading virtual cores engaged.

Cinebench 11.5 scored this laptop with 1.58 points single-core, and 7.38 points multi-core, which is at the top end of scores we've seen with laptops using this quad-core chip. Similarly, Cinebench 15 returned figures of 139- and 681 points, which is just above results of comparable gaming laptops.

For OpenGL graphics performance, version 11.5 played at 59.5fps while Cinebench 15 rose to 90fps. The latter score is good, but some way behind the 108fps we saw from the Gigabyte P37X using the same CPU/GPU combination.

PCMark 7 rated the P505 with 6217 points, an exceptionally high score for any PC. The PCMark 8 Home results of 2771 (conventional) and 3276 points (accelerated) were more disappointing, when the Gigabyte P37X scored 3300 and 4049 points in the same test. The Work results of 3018- and 4328 points were also some way behind the 3478- and 5156 points of the latter gaming machine sporting the same Intel and nVidia parts. It's worth mentioning that the Gigabyte resolves its performance storage in a different way, using two mSATA SSDs in RAID 0 rather than a single PCIe x4 SSD, which give broadly the same level of performance.

Storage

Thanks to the Samsung XP941 PCIe solid-state drive, the P505 we benchmarked was capable of very fast data transfers, up to 977MB/s sequential reads in our tests. Sequential writes were close at 891MB/s, and high speeds were also recorded for 512kB size data, 644- and 778MB/s respectively for reads and writes.

In the important 4kB random read/write tests we saw speeds of 24- and 76MB/s respectively for reads and writes, rising to 326- and 275MB/s using a 32-depth queue.

These are great results, unheard of from a single drive, though still behind what we've seen from a RAID'd pair of SATA SSDs.

Graphics

As we found with the last gaming laptop using the top nVidia GeForce GTX 980M graphics processor, it is possible to play graphics-heavy action games up to their highest detail, and usually even beyond full-HD 1920x1080 resolution.

Our simplest test for gaming laptops of Batman: Arkham City at 1920x1080 and High detail was quickly dispatched at an average framerate of 95fps. This fell to 89fps at Very High and 80fps at Extreme detail settings.

Given the nVidia chips clear fluency, we rose resolution all the way to screen native 2880x1620, where the game averaged 72fps at High detail and only fell to 62fps at the Extreme setting.

Tomb Raider 2013 sped by with even greater ease, at 217fps with Normal detail and full-HD screen resolution. We ratcheted up the detail to High (150fps) and Ultra (111fps) before hitting Ultimate and a still remarkable 76fps.

Having proved its mettle, we again went up to native '3K' panel resolution. This time Tomb Raider averaged 79fps with High detail, 57fps at Ultra and an accomplished 41fps at maximum Ultimate preset.

Presented with Metro: Last Light, the XMG P505 could play at an average framerate of 108fps in our standard full-HD High test, tumbling to 36fps at our top Very High settings.

Display

The 2880x1620 IPS display available to this laptop is an unusually fine example of the technology. In lab measurements it may not look too remarkable, its 94 percent sRGB coverage missing the full coverage some IPS panels provide, and contrast ratio reaching a middling best of 510:1.

Colour accuracy was good but again nothing exceptional with Delta E average of 1.34. What impressed with this Panasonic-made display was the subjective impression of image quality. Despite the measured results, black looked very deep and inky, type and images were incredibly detailed; and, of course, with clear viewing angles as wide as the screen.

Verdict

The Schenker XMG P505 is a very accomplished game player, fuelled by its top-of-the-range nVidia mobile graphics processor. The Clevo platform to support this is standard chunky games machine fare, although the all-up weight of around 2.6kg is modest by the standards of the breed. This laptop is distinguished by its premium IPS display, solid build and the graphics chip required to drive modern Windows games at their highest settings without fuss. And as a general PC, it feels commensurably quick, helped along by its 1GB/s-class PCIe solid-state drive. ☒ **Andrew Harrison**



LAPTOP

Apple MacBook Pro with Retina display (15in, 2.5GHz, mid 2015)

£1,049 inc VAT

Contact
■ apple.com/uk

Specifications
15.4in (2880x1800, 220ppi) LED-backlit widescreen display; OS X Yosemite; 512GB PCIe-based flash storage; 2.5GHz quad-core Intel Core i7 processor (Turbo Boost up to 3.7GHz) with 6MB shared L3 cache; 16GB of 1600MHz DDR3L onboard memory; Intel Iris Pro Graphics; 720p FaceTime camera; 802.11ac Wi-Fi networking; 4 IEEE 802.11a/b/g/n compatible; Bluetooth 4.0; 1x MagSafe; 2x Thunderbolt 2; 2x USB 3.0; 1x HDMI; 1x headphone; SDXC slot; 18x358.9x247.1mm; 2.04kg

Build:
Features:
Performance:
Value:



The new 15in MacBook Pro for 2015 has arrived, picking up a trio of component upgrades on the way. Apple's best laptop features the same design and layout as the first Retina notebook that launched in 2012, and once again two models are available – here we focus on the top model with 2.5GHz processor and AMD graphics.

Apple pioneered the trackpad on laptops back in the early 1990s, when Windows laptop factories were still fitting upside-down-mouse trackballs or little rubber pointing sticks in the middle of the keyboard. The trackpad is now all but ubiquitous as the way to interact with every notebook computer of any faith.

Under Apple's stewardship, the concept has seen trackpads grow larger in size, increase in precision and sensitivity, and notably gain multi-point touch recognition to allow new hand gestures to guide the user through a computer's GUI.

The new Force Touch trackpad is something of a departure though, and even though the trackpad looks identical on the surface, it is now a fixed unmoving construct, relying on strain gauges, electromagnet solenoids and additional processors and algorithms to do its work. Superficially, the same as it was in the first Unibody MacBook of 2008 it may be, but still waters run deep.

As we found with first the 13in MacBook Pro and then the new little MacBook, the Force Touch trackpad allows you to control the strength of the 'click' for normal clicks (Light, Medium, Firm); and additionally to register an extra, deeper click when you press slightly longer and more firmly.

The Force Touch concept works well on the MacBook Pro, allowing you to deep click on the fast-forward and rewind buttons in QuickTime Player, for example. The harder you press, the faster the speed-up. Another useful benefit, if one that takes some mental training to get used to if you've been driving trackpads for years, is that you can press anywhere on the trackpad surface with equal pressure to elicit a click, rather than along just the front edge.

Apple does not seem too partisan when it comes to favouring either of today's two makers of PC graphics processors, tending to oscillate between fitting either nVidia or AMD's graphics adaptors. Since the 15in MacBook Pro with Retina display was introduced back in 2012, there has been a build using discrete nVidia graphics in addition to low-power integrated Intel graphics, starting with the nVidia GeForce GTX 650M for the Mark I; and for the past two refreshes, the slightly better GTX 750M.

Now we see the pendulum swing back to AMD, with the inclusion of a Radeon R9 M370X graphics processing unit. It is fitted with 2GB of GDDR5 video memory, the same quota as the outgoing nVidia part.

Graphics

You won't find this AMD graphics processor on other laptops though as the part seems to be custom-built for Apple. Note that like all GPUs that Apple has fitted to its professional-label MacBook Pro notebooks ever since the line was launched in 2006, the 2015 MacBook Pro takes a consumer-grade graphics adaptor, here bearing the Radeon name.

The AMD Radeon R9 M370X looks to be based on a 28nm architecture codenamed Cape Verde that dates back to 2012, and this particular version runs an 800MHz GPU clock, 1125MHz memory clock (4500MHz effective speed, after the quadrupling properties of GDDR5 RAM) and 128-bit memory bus. It has 640 stream processors for parallel processing and 40 texture mapping units.

Comparing the AMD chip with nVidia's graphics is not easy, as its architecture is slightly different, with a specification listing shading units (384) and render output processors (16) besides a count of 32 texture mapping units. However, the previous nVidia GTX 750M did have a slightly faster core-clock speed of 926MHz, the same size 128-bit memory bus, and a faster memory clock of 1254MHz.

Apple reports that the new AMD graphics are faster than the outgoing nVidia solution, and these claims were borne out in our testing in every instance, up to and including a 70 percent performance increase in one game.

Before the graphics benchmark results, it's worth reiterating that the CPU is the same as when we last tested the breed in summer 2014. We ran the usual processor tests anyway as part of our comprehensive routine to ensure nothing unexpected had arisen, and found figures that were within 1 percent tolerance of last year's results. This means a single-core Geekbench 3 score of 3717 points, rising to 14,325 points in multi-core mode; Cinebench 11.5 with results of 1.54- and 6.41 points respectively for the two modes; while Cinebench 15 reported 132- and 602 points.

For reference, Dell's comparable copycat computer is the Precision M3800, which runs an Intel Core i7-4712HQ at 2.3GHz, and gives benchmark scores around 5 percent slower in Cinebench, and up to 18 percent slower in Geekbench.

Cinebench will also test graphics rendering performance with an OpenGL routine, and in our tests of the mid-2015

MacBook Pro with its new AMD graphics we found 12.5- and 16 percent improvements over the previous nVidia model. Specifically, Cinebench 11.5 framerate rose from 48- to 54fps, while Cinebench 15 advanced from 54- to 63fps.

Turning to gaming, we started with Batman: Arkham City and found it would play around one-third faster. At the low setting of 1280x720 pixels and Medium detail, nVidia gave us 61fps, while AMD played at 83fps (36 percent faster).

Set to 1440x900 size – arguably the best resolution for this MacBook Pro's 2880x1900-pixel display – the game rose from 50fps through nVidia GeForce GTX 750M, to 66fps through the AMD Radeon R9 M370X, for a 32 percent improvement.

Unigine Heaven is a synthetic gaming benchmark, and here the AMD graphics showed around 20 percent improvements on the previous nVidia – moving from 35- to 42fps (1280x800, Medium), and from 29- to 35fps (1440x900, Medium).

Most impressive gaming performance lifts were found in the 2013 reboot of the classic Tomb Raider game. In our experience testing Windows machines, this game typically works better through AMD graphics hardware – right down to the added TressFX graphics API for DirectX, which optionally shows Lara's hair more realistically, each strand rendered separately with the help of the AMD Graphics Core Next architecture. Sadly this feature has not been ported to the OpenGL version of Tomb Raider for Mac.

Set to a modest 1280x800-pixel resolution and Normal detail, framerate was lifted from 40fps under nVidia to 65fps under AMD (63 percent faster). At 1440x900, Normal detail moved from 33- to 56fps (the vaunted 70 percent improvement) and from 31- to 49fps at High detail (or a 58 percent lift).

With the help of QuickRes (quickresapp.com,) we also pushed the graphics to their size limit, expanding screen resolution beyond what OS X normally allows, to the MacBook Pro's native 2880x1800 pixels. At this point, you cannot expect to have playable framerates from anything but the best graphics cards. For the nVidia 750M, it averaged 9fps in Tomb Raider, while the AMD R9 M370X showed us a much better, if still too slow, 18fps. That's what statisticians and marketeers would call a 100 percent improvement.

Performance

We've already seen some significant improvements in storage performance in this year's Apple Mac refreshes, building on the 2013 refresh when Apple kicked out SATA and introduced PCIe-attached flash drives to the world.

This year saw this strategy developed again by the use of four rather than two lanes of PCI Express. So in the case of the new 13in MacBook Pro with Retina display, sequential read speed from the PCIe-attached flash drive doubled from around 750- to 1500MB/s.

This year's 15in Retina MacBook Pro also gains from the doubling in PCIe bus lanes, again from two to four. But it also adds another trick that takes sequential read speed up to a staggering 2000MB/s. In place of the venerable PCIe 2.0 standard, we now have a flash drive using four lanes of PCIe 3.0. The newer standard has nominal speed of 8GT/s (giga transfers per second), a bump up from the previous 5GT/s of PCIe 2.0.

Using QuickBench, we measured storage transfer speeds in excess of 2000MB/s, peaking at 2077MB/s, and averaging 2050MB/s for data sized 20- to 100MB. Sequential write speeds were lower as is typical for SSDs and averaged 1542MB/s.

Small-file random reads were almost disappointing, the weakest in measurement at 37MB/s for 4kB random reads, while 4kB random writes hit 118MB/s. Averaged across all small files from 4- to 1024kB, random reads were 533MB/s and random writes averaged 948MB/s.

Compared to 2014's best, which came in at 199MB/s for averaged random reads and 351MB/s for averaged random writes that's roughly a three-fold increase since the last refresh, and one that will really make the Retina MacBook Pro fly in real-world usage.

We have seen a clear evolution in Mac storage performance in the past two years; a revolution in terms of the shake-up to the PC industry. Up until the MacBook refreshes of 2013, the best SATA SSDs had read speeds capped by SATA interface at little over 500MB/s.

Then Apple replaced SATA with PCIe, giving a 50 percent read speed increase to 750MB/s. Then earlier this year it used twice as many PCIe lanes, doubling that 750 figure to 1500MB/s. And now the lanes have been widened to expand the top speed to 2000GB/s.

Last year's MacBook Pro (Retina, 15in, mid 2014) with the same 2.5GHz Core i7 processor lasted for seven hours 57 minutes, in our test of streaming an MPEG-4 HD film over Wi-Fi, with screen set to 120cd/m^2 (an 11.75 setting on the 0-16 brightness range available through OS X).

This year's model with the same CPU ran for eight hours 58 minutes, which we're happy to call 'nine-hour battery life'. If we had to guess the 'how', we'd wager it was either improved power-saving techniques in the Samsung-made flash drive controller; reduced quiescent current draw from the AMD graphics processor; or it could be a little of both, combined with some under-bonnet changes in the OS.



Verdict

Apple's latest 15in Retina MacBook Pro maintains its place as a premium mobile workstation laptop, with great performance and a stylish design. ☒ **Andrew Harrison**

ALL-IN-ONE

iMac with Retina 5K display (mid 2015)

£1,599 inc VAT

Contact
■ apple.com/uk

Specifications
27in (5120x2880) Retina display with IPS technology; 3.3GHz quad-core Intel Core i5 processor (Turbo Boost up to 3.7GHz); 8GB (two 4GB) of 1600MHz DDR3 memory; four SO-DIMM slots, user accessible (configurable to 16GB or 32GB); 1TB (7200rpm) hard drive (configurable to 3TB hard drive), 1- or 3TB Fusion Drive, or 256GB, 512GB or 1TB of flash storage (SSD); FaceTime camera; 1x headphone; 1x SDXC; 4x USB 3.0; 2x Thunderbolt 2; gigabit ethernet; 802.11ac Wi-Fi wireless networking; IEEE 802.11a/b/g/n compatible; 516x650x203mm; 9.54kg

Build: ★★★★½
Features: ★★★★½
Performance: ★★★★☆
Value: ★★★½☆



When Apple launched the first iMac with Retina display last October, it stood alone in terms of competition from the usual Windows suspects, since no PC maker had anything close in design and performance.

But it was also launched as a solitary model in the Apple catalogue, listed as just one standard configuration, although there was some limited scope to upgrade to better processor, graphics, storage and memory.

Now we have an additional off-the-shelf Retina 5K iMac with £400 shaved off the £1,999 (now reduced to £1,849) price of the original. Your £1,599 can buy an iMac with the same ultra-high resolution screen and all the usual trimmings, with savings made this time in the main Intel chip, the storage and graphics.

Build and design

In every respect this is the same iMac with Retina 5K display, using the same chassis with the same formidable build quality, and the same line of ports and connectors along the back. There's two Thunderbolt 2 ports for high-speed peripherals and external displays, four USB 3.0, gigabit ethernet, and slot for SD cards up to SDXC specification and a headphone jack.

In place of the 3.5GHz Intel Core i5 quad-core processor is a slightly slower processor clocked at 3.3GHz. It's from the same generation, a Core i5-4590 instead of Core i5-4690. Both chips have separate processor cores on the same die, and include Intel Turbo Boost 2.0 technology which here mildly overclocks up to 3.7GHz, where the faster processor can reach up to 3.9GHz.

These are regular four-core chips. In both cases, the processor is fixed at working on four threads, in contrast to the mobile-class processors found in most variants of Apple MacBooks, which include Hyper Threading Technology to give the effect of doubling the number of real cores. The memory quota and specification is the same as before, 8GB from two 4GB SO-DIMM modules, and you can easily upgrade this yourself from a removable hatch on the back

In our tests of the main processor, we saw close to the same speed as from the 3.5GHz processor, with benchmark scores around 5- to 6 percent lower.

From Geekbench 3, the new iMac with 5K Retina scored 3699 points with one core, and 11,792 while running four cores. Those figures are around 5 percent lower than the 3877- and 12,418 points from the original iMac 5K.

Cinebench 15 scored the 3.3GHz iMac with 134- and 515 points for its two modes, this time 6- and 5 percent behind the first model's scores (143- and 544 points respectively). The earlier version of Cinebench 11.5 reported the same story, dropping 5- and 6 percent (1.64 down to 1.56 points, and 6.15 down to 5.79 points).

> Your £1,599 can buy an iMac with the same ultra-high resolution screen and all the usual trimmings, with savings made this time in the main Intel chip

At first glance, we have the same graphics processor driving all those 14.7 million pixels with 60 refreshes each second. But there's something different in the designation, a certain X missing from the end of the device's name. Where the first iMac 5K has an AMD Radeon R9 M290X, the second has an R9 M290. Technical differences between them are not revealed and we've asked Apple if it can explain how they are different. Until we hear more, and based on the tiny measured differences in performance between GPUs, we'd guess it could be something as minor as a difference in the core or memory clock speeds.

Graphics processors can be 'binned' by selecting the best silicon from the fabrication process at time of manufacture, and setting these parts to run with the highest clock speeds. Those parts that don't work with stability at the top speeds are set at slower clock speeds, and used in lesser graphics cards.

Graphics

As with Intel processor performance, the change of graphics processor see a small drop in the results we measured from the original 3.5GHz iMac 5K. Batman: Arkham City at 1920x1080 pixels and High detail still played perfectly at 84fps, where first model managed 89fps.

When pushed to a Retina-mode resolution of 2560x1440 however, we saw a more significant drop in framerate, even if 66fps instead of 85fps is still perfectly usable to play the game without visible glitches.

Tomb Raider was strangely faster at full-HD resolution when played on the new 3.3GHz model, averaging 64fps against 59fps, for a nearly 7 percent improvement. But pushed to 2560x1440 size again it fell back by 10 percent, hitting 42fps instead of 46fps from the original 5K iMac. The Unigine Heaven synthetic game benchmark was similarly around 10 percent down, but still able to play the test at 27fps even at 2560x1440 and Medium detail.

Cinebench's OpenGL test pushes the graphics processor while rendering an animated car-chase scene, and here the new iMac was just 1.4 percent behind the original in version 15 (90.4 versus 91.7fps); and again we saw an anomaly where the non-X-rated iMac turned in a higher score in the older 11.5 benchmark (56.3- beating 45.1fps, for a 20 percent better score in the cheaper Mac).

Storage

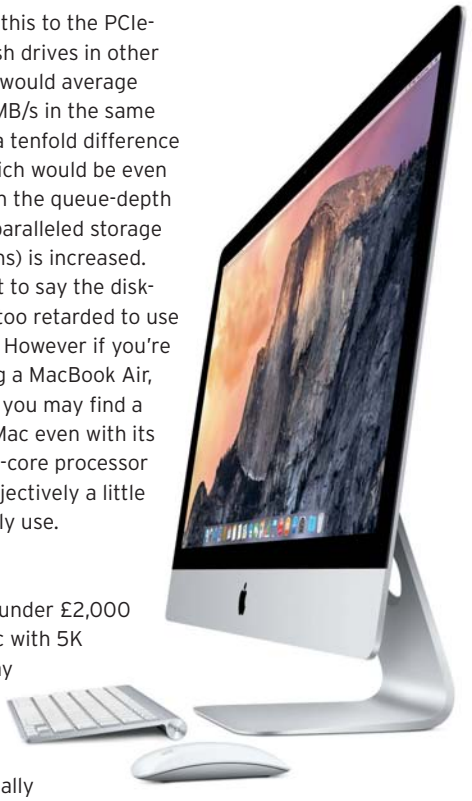
As standard the original iMac with 5K Retina display comes with a 1TB Fusion Drive, a hybrid flash and disk system that works seamlessly to give you most of the benefits of a fast solid-state drive, and the bulk capacity of a traditional hard disk.

The new entry-level version iMac is equipped with just a simple 1TB disk, which does make this model feel slower in general use. Start-up time is lengthened, even if this yardstick from the Windows PC world is almost insignificant here since Macs excel at sleep mode; and don't demand restarting every Tuesday to apply weekly security patches from Microsoft. But there is some inevitable lag in the system interface, noticeable when applications take a few more bounces in the Dock before they launch.

The Seagate hard disk inside this new iMac is fast though as disk technology can allow. With the drive nearly empty, it could reach sequential speeds up to around 210MB/s (with reads and writes effectively the same speed); the drag really starts to show when multiple demands are made upon the disk drive, and in small-file random read/write speeds. Averaged with data from 4- to 1024kB, we saw speeds of around just 30MB/s.

Compare this to the PCIe-attached flash drives in other Macs, which would average around 300MB/s in the same latter test – a tenfold difference in speed, which would be even marked when the queue-depth (number of paralleled storage I/O operations) is increased.

That's not to say the disk-only iMac is too retarded to use comfortably. However if you're used to using a MacBook Air, for instance, you may find a disk-based iMac even with its 3.3GHz quad-core processor may feel subjectively a little slower in daily use.



Verdict

For a pound under £2,000 the first iMac with 5K Retina display actually offers decent value, especially with nothing like it to compare, short of gaffer-taping a 4K UHD display onto a Windows tower PC. The new entry version undercuts it by a useful £400, bringing only around 5 percent slower application and 10 percent graphics performance. It does lose out with the slow disk-only storage though, so you might like to consider configuring it with a Fusion Drive or pure 256GB flash drive, either option adding £160 to the price.

☒ **Andrew Harrison**



SMARTPHONE

EE Harrier

£199 inc VAT

Contact
■ ee.co.uk

Specifications
5.2in full-HD (1920x1080, 424ppi); 1.5GHz Qualcomm Snapdragon 615 octa-core processor; 2GB RAM; 16GB storage; microSD slot; 13Mp rear camera with LED flash, 1080p video recording; 2Mp front camera; Android Lollipop; 4G up to 150Mb/s; Micro-SIM; Wi-Fi Calling coming soon; 802.11b/g/n Wi-Fi; Bluetooth 4.0; NFC; 2500mAh non-removable battery; 74.5x8.9x147mm; 145g

Build:
Features:
Performance:
Value:



The fact the £199 Harrier is available on EE's 4G network is exciting not only because it's fast, but because later this year the phone will also benefit from EE's Wi-Fi Calling service. This eliminates mobile signal problems by allowing you to route calls and texts over Wi-Fi, without you even realising it's happening.

At this price, you can't expect a premium build. On the plus side, the bezels are extremely thin, the phone is reasonably slim for a budget model and also lightweight, and the 5.2in full-HD (1920x1080, 424ppi) screen is fantastic under £200.

With an IPS display, the EE Harrier offers realistic screen colours, decent viewing angles and it's usefully bright. At 5.2in – large but not too large – it's also a great fit for watching movies and viewing photos, which isn't often something we can say about phones at this price point. (Gaming, not so much, but casual games will play fine on the Harrier.)

EE has made an effort to spruce things up, with a brushed-metal-effect rear (it's still plastic) and a gold camera surround; as an own-brand phone you'll also find a silver EE logo on the back cover. The slightly curved rear and rounded corners make the Harrier fit naturally in the hand, too.

But a few things give away this phone's mid-range price. First and foremost, it's entirely plastic, and that brushed-metal-effect rear does little to conceal the fact. The removable cover adds to this cheap feel, with the Harrier creaking a little in use. Given that the battery is not removable, we'd have preferred to have seen a side-loading tray for the Micro-SIM and microSD card, and a fixed rear.

The button placement is bizarre. Unusually, EE Harrier is far more comfortable to use in the left hand than it is in the right. Held in your left hand, the thumb falls naturally over the power button and fingers over the volume rocker; held in the right hand, the distance between the two is simply too great, and all the steps EE has taken to make the phone comfortable to use in one hand quickly become forgotten as you struggle to adopt the awkward hand contortions necessary to operate the Harrier. Sadly, for EE, this reviewer is right-handed, but lefties will love it.

Hardware and performance

On the inside, the Harrier is equipped with a 1.5GHz Qualcomm Snapdragon 615 octa-core processor, 2GB of RAM and 16GB storage, which can be expanded via a microSD slot – and you'll want to do so. Having installed our benchmarks less than half the capacity was available (and they really aren't that big). A 2500mAh non-removable battery keeps it all going.

That sounds like a reasonable specification for a mid-range phone, but during testing we found that the Harrier would take a second or two to think before doing whatever you had asked of it, whether that was launching an app or opening the Settings menu. Remember, though, that this is a £200 phone. We're used to reviewing super-fast handsets such as the Samsung Galaxy S6, which cost three times the price, and what seems like an interminable wait to us an average user wouldn't bat an eyelid at. For that reason, we also measure performance using several benchmarks.

In our benchmarking of the Harrier, we found performance similar to that of Chinese phones such as the ZTE Blade S6 and S6 Plus, Doogee F1 Turbo Mini and Bluboo X6. Some of these devices are significantly cheaper than the Harrier, but while you might save money buying phones from China (the EE Harrier is also made in China, but sold in the UK through EE), you could also get hit with additional customs charges, and if you need to return a faulty device you could have trouble. By buying direct from EE, you should be able to get any problems sorted relatively quickly and easily.

In Geekbench 3, which measures processor performance, the EE Harrier recorded 640 points in the single-core test, and 2042 in the multi-core one. That makes it a little slower than the ZTE Blade S6 (2420) and S6 Plus (2095), but faster than the Doogee F1 Turbo Mini (1947) and Bluboo X6 (1940). Comparing it to some other phones with which you may be more familiar, it's slower than an LG G2 (2271), but faster than the HTC Desire 816 (1503) and new Moto E 4G (1463). Importantly, it's much faster than EE's previous own-brand 4G phone, the Kestrel, which recorded 1152 points (at half the price, mind).

Next up is SunSpider, which measures JavaScript performance (and in which a lower score is better). We run this benchmark in Chrome to ensure a fair test across phones, and saw 1275ms for the Harrier. That places it very much in Microsoft Lumia or Windows Phone territory, with the 640 scoring 1201ms, the 735 1217ms, the 435

1284ms and the 535 1295ms. In comparison to Android phones, it's in the Huawei P6/P7 and HTC Desire 610's domain – not amazing, but by no means atrocious (the Sony Xperia Tipo still wins that award with 5781ms).

A new test for us is AnTuTu, in which the Harrier recorded 29,154 points. We have few inhouse results with which to compare this, but according to other results in the AnTuTu database that makes it faster than the original HTC One (M7), but slower than the Nexus 5 and LG G3.

Graphics performance comes next, for which we use GFXBench 3.1. In the T-Rex test, EE Harrier recorded 15fps, which is slightly faster than the Kestrel (14fps), and on a par with the HTC Desire 610, LG G2 mini and Sony Xperia M2. In Manhattan we saw just 6fps, which is the same score we saw from the new Moto E 4G. This phone hasn't been designed with gaming in mind, but you should find it capable of handling casual titles.

Finally, we measure battery life performance, and for this we again turn to Geekbench 3.0. As with AnTuTu, this is a relatively new test to the *PC Advisor* lab, and we have few scores with which to compare the Harrier's performance. However, of the scores we do have, the phone turned in by far the worst performance with 1424 points (03:33:20). Even its little brother, the Harrier Mini (see page 34), performed better, with 2163 points (05:24:10). While you might assume this difference could be put down to the lower-spec hardware on the Mini, the phone that scored the highest in this benchmark was the Samsung Galaxy S6, which has a much higher-resolution screen, significantly faster hardware and only 50mAh extra in the battery department.

With moderate real-world use, the Harrier should get you through the day, but expect nothing more beyond that. Smart battery options let the Harrier automatically turn off Wi-Fi and data connectivity when the screen is off. You can set this to occur only between certain 'off-peak' times, such as overnight when you don't want to be disturbed, or to happen all the time. However, if you want people to be able to get hold of you, that's perhaps not the best idea. The Harrier can also show you which apps might be causing excessive battery drain.

Connectivity

A key selling point of this phone is its 4G connectivity. At £100 that would be impressive; at the £200 the Harrier costs, it's a nice extra – not all phones at this price have it, but neither is it a surprise, and especially not in an own-brand EE handset.

One of the perks of buying an EE phone, though, is Wi-Fi Calling. This is not yet available to the Harrier, but it will be later this year. Wi-Fi Calling is a god-send if you often find yourself without mobile signal, allowing the Harrier to route your calls and texts over a Wi-Fi- rather than a mobile network. You won't even notice the difference, and the minutes and texts you use simply come out of your monthly allowance.

In other respects all the usual connectivity bases are covered. There's 802.11b/g/n Wi-Fi, Bluetooth 4.0 and NFC but, unlike many Chinese-made phones, the Harrier is not dual-SIM.

On paper, the 13Mp camera fixed to the rear of the Harrier is excellent. It has an LED flash, and a gold camera surround makes it all seem a little bit special. It can capture 1080p (full-HD) video, and there's also a 2Mp selfie/Skype camera at the front.

Very few camera controls are available, but you do get smile-, voice- and touch-activated capture, plus a countdown timer. You can select Auto, Night or Panorama modes, while HDR is on or off, and no real-time filters are available.

The results, as you can see in our test shots below, aren't bad. But you'll want to switch on HDR (as seen in the second shot), and even then detail is lacking. Colours are natural, though, and for the money the results are acceptable.

We also ran a video test using the primary camera, but found the footage to be jerky.

When it comes to its operating system, the Harrier runs a very plain implementation of Android Lollipop, and even uses the Nexus launcher. There is, however, a lot of bloatware slapped on top, and none of it can be uninstalled. Additional extras include Lookout, My EE, Amazon Kindle, Local, Music and Appstore, Deezer and Games & Apps. By the time we had installed our benchmarks, just 7.89GB of the Harrier's 16GB of storage was available.

Verdict

At £200, EE's Harrier offers 4G connectivity, a great 5.2in full-HD IPS screen and the promise of Wi-Fi Calling. For many that will make it an excellent deal. But a number of issues prevented us getting too excited about this smartphone: there's a load of bloatware, relatively sluggish performance, unremarkable battery life, some awkwardly placed buttons, a plastic build, and the camera performance isn't great. ☒ **Marie Brewis**



SMARTPHONE

EE Harrier Mini

£99 inc VAT

Contact
■ ee.co.uk

Specifications
4.7in (1280x720, 312ppi) IPS HD screen; 1.2GHz processor; Android 5.0 Lollipop; 1GB RAM; 8GB storage (3.69GB available); microSD card slot; Bluetooth 4.0; Wi-Fi Calling; 8Mp rear (with LED flash), 2Mp front camera; 2000mAh non-removable battery; 138x67.9x9.5mm; 124g

Build:
Features:
Performance:
Value:



At £99, the Harrier Mini offers a cheap entry point for a phone capable of fast 4G data download speeds. It's identical in design to its bigger brother, the Harrier (see page 32), but with smaller dimensions and a more modest spec.

Both are plastic phones, although the manufacturer (BenQ) has attempted to add a touch of flair with a brushed-metal-effect rear cover. There's also a gold camera surround, shiny silver EE logo and a silver speaker grille at the rear. It pulls off the look much better than its bigger brother, and on looks alone you wouldn't easily guess that this was a £99 phone.

The screen bezels are similarly slim, but as with the Harrier there is a rather large vacant area below the screen. Rather than using this to house the three Android-standard Home, Back and Options buttons, these occupy the bottom row on the screen itself. Even so, with smaller overall dimensions the Harrier Mini is far easier to operate in a single hand, and even the slightly odd button placement that felt awkward on the Harrier feels natural here.

In the hand, the Harrier Mini feels good. The slightly curved rear is a good fit for the palm, and it doesn't creak under pressure. You can prise off this panel to reveal microSD and SIM slots, but it's a shame the battery isn't also removable.

Given that the Harrier Mini costs half the price of the Harrier, some cost-cutting has been necessary. Whereas the Harrier is fitted with a 5.2in full-HD panel, the Harrier Mini has a 4.7in HD variant. Both are IPS panels with good viewing angles and generally realistic colours, but while the Harrier Mini's screen is very sharp for a budget phone you will notice the difference between it and the Harrier. We also found it a little dull without turning up the brightness, but doing so had the negative effect of making colours seem a little washed out.

Don't expect to be blown away by this phone's performance, with a lowly 1.2GHz processor and just 1GB of RAM. Oddly, the Harrier Mini felt faster than the Harrier in real-world use, with no lag when switching between home screens and scrolling through menus, although there is still the same interminable wait when launching the camera or other apps, or even just waking the screen.

We ran the Harrier Mini through our usual benchmarks, starting with Geekbench 3, which measures processor performance. In the multi-core component it recorded 1549 points, making it faster than its predecessor, the EE Kestrel (1152), but slower than the Harrier, which recorded 2042 points.

Geekbench 3 also includes a battery life test, which we have recently begun using for the phones that pass through our lab. We were interested to find that the Harrier Mini performed better in this test than did the Harrier, despite its smaller-capacity battery (2000mAh vs 2500mAh). This is more than likely due to the less demanding hardware. We recorded 2163 points for the Harrier Mini, and just 1424 for the Harrier. Don't expect to get more than a day's usage from that battery before needing a top-up.

You get the same power-management options as with the Harrier, which means you can turn off Wi-Fi and mobile data when the screen is off, or schedule this to occur only during a set period, such as overnight. If you want people to be able to get hold of you then it's perhaps not the best solution to prolonging battery life, however.

Another test we run is GFXBench, within which we use the T-Rex and Manhattan benchmarks to gauge graphics performance. The Harrier Mini recorded 10- and 4fps respectively, which is by no means great, but the phone will be capable of casual gaming.

With the exception of NFC, the Harrier Mini has the same connectivity options as the Harrier. That means you get 802.11b/g/n Wi-Fi and Bluetooth 4.0, plus the promise of Wi-Fi Calling – it's only a shame it wasn't available to the Harrier and Harrier Mini at launch.

Photography is another area in which the Harrier Mini sees cutbacks, although its 8Mp rear- and 2Mp front camera setup with LED flash is very good at this price.

HDR is not on by default, although in our experience you will want to switch it on. Our first shot, taken without HDR, was very dark and underexposed on what was a relatively sunny day for the UK. Although the results were much better with HDR, it's clear a lot of detail is still missing.

The Harrier Mini can also shoot full-HD (1080p) video from its rear camera, although we found it jerky and struggling to focus, with the same exposure issues as still shots.

The camera app itself is basic, matching that found on the EE Harrier. Very few camera controls are available, but you do get smile-, voice- and touch-activated capture, plus a countdown timer. You can select Auto, Night or Panorama modes, but no real-time filters are available.

The software setup is identical to that of the Harrier. You get a very plain implementation of Android Lollipop, complete with the Nexus launcher. However, there is a lot of bloatware slapped on top, and none of it can be uninstalled. Additional extras include Lookout, My EE, Amazon Kindle, Local, Music and Appstore, Deezer and Games & Apps. By the time we had installed our benchmarks, only 3.69GB of the Mini's 8GB of storage was available.

Verdict

We're much keener on the Harrier Mini than we are its bigger brother. Performance is slower and the screen isn't as good, but it's still a great deal. ☒ **Marie Brewis**

SMARTPHONE

Samsung Galaxy A3

£249 inc VAT

Contact
■ samsung.com/uk

Specifications
4.5in Super AMOLED (960x540, 244ppi) screen; Android 4.4.4 KitKat; Qualcomm Snapdragon 410; 1.2GHz quad-core processor; Adreno 306 GPU; 1.5GB RAM; 16GB internal storage; microSD card slot (up to 64GB); 13Mp rear camera with LED flash; 5Mp front camera; Wi-Fi 802.11 b/g/n (single-band); Bluetooth 4.0 LE; non-removable 1900mAh battery; 130x66x6.9mm; 110g

Build:
Features:
Performance:
Value:



We've already reviewed the Galaxy A5, which turned out to be a nicely built mid-range Android phone, but too expensive given the mediocre components inside it. But what about its smaller brother, the A3?

Not everyone wants a phone with a huge screen and the A3 offers a 4.5in qHD Super AMOLED display. To unpack the acronyms, this means it has a resolution of 960x540 pixels, which is a quarter of the number in a full HD screen (1920x1080).

Many phones have LCD displays, but Super AMOLED is completely different. Like other OLED displays, individual pixels emit light rather than there being a backlight which illuminates an entire LCD screen. This means contrast is better and AMOLED screens also have more vivid colours, in general.

So, given its price, the A3 has a relatively low resolution but good-quality screen. Some will think it looks a little blocky or fuzzy if coming from a phone with a higher-resolution screen, but the 244ppi pixel density means it's acceptable.

As with the A5, the A3 has an aluminium unibody much like an iPhone. It looks stylish and is slim and lightweight at 6.9mm and just 110g. There's a physical home button, with touch-sensitive back and recent buttons either side of it. Micro-USB and headphone sockets can be found on the bottom edge and iPhone-style trays hold a nano SIM and up to a 64GB microSD card on the right-hand side. The sleep/wake button is above the trays, and the volume rocker is on the left. Mounted centrally on the back is a camera that's flanked by an LED flash and the main speaker.

You get the same choice of four colours: white, black, gold and silver.

Like the A5, the A3 runs Android KitKat. That's strange given that the new version – Lollipop has been around for six months now. However, an update to Android 5.0 for both phones is rolling out right now.

Samsung's TouchWiz interface masks most of Android anyway, so the upgrade won't be as noticeable as on a phone running plain Android. It's still worth having Lollipop though for its other features.

You might expect the A3 to have the same internals as the A5, but you'd be wrong. Yes, there's the same Snapdragon 410 processor with the Adreno 306 GPU, but you get only 1.5GB of RAM instead of 2GB and only an 8Mp camera at the rear instead of 13Mp. Wi-Fi is single-band in the A3, so unlike the A5 it won't be able to connect to 802.11n routers on 5GHz. It's a non-issue for most people, of course.

The front camera is the same at 5Mp, and there's Bluetooth 4.0, GPS and NFC. There's also 4G LTE support as well as 3G. The A3 is one of few phones with built-in ANT+ support, which could be useful if you have any ANT+ fitness gadgets.

Unsurprisingly, the A3 is more or less exactly as fast as the A5. In our tests, it returned roughly the same scores and in general day-to-day used proved fast enough. The problem is that it's not really good enough for the price: you can buy the Motorola Moto E for just £109, which has the same processor, supports 4G and has basically the same screen size and resolution.

The battery is rated at 1900mAh which is a lot less than the 2300mAh cell in the Galaxy A5. In general use though, we found the A3 would last a full day with no problems. There's the same Ultra Power Saving mode as the A5, which extends standby time for over a day even if you're down to 10 percent.

In our battery test, the A3 lasted just a couple of minutes shy of six hours. That's only quarter of an hour less than the Galaxy A5, despite the smaller battery. Overall, it's a decent result.

One area where the Moto E 4G shows its budget nature is the plastic body. But the low-resolution cameras also let it down. In this respect the Galaxy A3 is much better. Photos have a decent amount of detail and are sharp. Don't expect quality to rival the iPhone 6's 8Mp camera, but snaps are respectable enough to share with family and online.

Bear in mind that both cameras default to a 16:9 aspect ratio, which means they take lower resolution photos (6Mp rear, 3.7Mp front) unless you change the settings to use their native 4:3 aspect ratios.

Also, the front camera defaults to selfie mode which itself automatically retouches your face giving a strange plastic look. With this disabled, photos from the front camera are very good. Along with the handy options for automatically taking selfies when holding up your palm and a wide-selfie mode, the A3 is a good choice if you take a lot of photos of yourself.

Verdict

Samsung's RRP is £249, but you can buy the Galaxy A3 SIM-free for a little under £200 if you search around online. If you do want it on contract, there should be no up-front cost. But as we've said, it's possible to get a phone with similar specifications for a lot less, so it's hard to justify spending the extra on the A3 for its cameras or even Samsung's software. ☒ **Jim Martin**

SMARTPHONE

Ulefone BeTouch

£147 (plus import duty)

Contact
■ ulefone.com

Specifications
5.5in HD (1280x720, 267ppi) IPS 2.5D Arc screen with Corning Gorilla Glass 3; Android 5.0 Lollipop; 1.7GHz MediaTek MTK6752 (ARM Cortex-A53) octa-core 64-bit processor; 3GB LPDDR3 RAM; 16GB storage (plus microSD up to 64GB); Mali-T760 MP2 dual-core GPU; 4G FDD-LTE/3G WCDMA/GSM; dual-SIM dual-standby (1x full-size, 1x Micro-SIM); dual-band 802.11b/g/n/ac Wi-Fi; Bluetooth 4.0; OTG; GPS; A-GPS; GLONASS; fingerprint scanner; 13Mp Sony Exmor IMX214 rear camera, dual-LED flash, 4K video recording; 5Mp front camera with 80-degree wide-angle lens; 2550mAh removable battery; 77.4x8.6x158.1mm; 160g

Build: ★★★★☆
Features: ★★★★☆
Performance: ★★★★½
Value: ★★★★½

★★★★½

Ulefone's BeTouch is a Chinese phone that's available to buy in the UK through Geekbuying for just £147 at the time of writing. Bear in mind that Geekbuying ships the BeTouch from China, so you may also incur import duty. If you do decide to take the plunge and purchase the BeTouch, you absolutely won't regret your choice.

With a 5.5in HD (1280x720) screen, the Ulefone is a large phone and what we refer to as a phablet – somewhere between a phone and a tablet. However, the aviation-grade stainless steel frame and aluminium-magnesium mid-frame help keep down the weight to just 160g, while the curved screen edges and slim bezels make one-handed use possible.

Despite the metal frame, the Ulefone's rear cover is plastic. It's a removable cover that, usefully, affords access to an also-removable battery and the dual-SIM and microSD slots. It sits flush to the case, which prevents it feeling cheap or creaking in the hand.

The 13Mp camera protrudes a little from the rear – it's not something we particularly like, but it is becoming increasingly common with today's ever-slimmer flagships. While the BeTouch isn't as skinny as some phones on the market, at 8.6mm it's thin for a budget phone.

Our sample came in metal grey, although the BeTouch is also available in silk white. The fully laminated display is prone to picking up fingerprints, but the HD IPS display below looks good. At this size and resolution, the screen is a good fit for viewing media, and it displays realistic colours and useful brightness, with good viewing angles to boot. You can also invert the screen colours if you find the display easier to read in this manner.

The power button and volume rocker are found on the phone's left edge, which can be a bit of a stretch for right-handed users. However, one of several useful gestures allows you to wake the screen with a double-tap, so we didn't find the positioning a problem in real-world use. Options and back software buttons sit below the screen, either side of a home button that incorporates a fingerprint scanner.



PC ADVISOR RECOMMENDED

The beauty of this fingerprint scanner, and something we haven't been able to say about any of the fingerprint scanners found on rival cheap Chinese phones, is that it works. Using touch- rather than swipe input, we found the BeTouch recognised our fingerprint every single time, and that means we're actually likely to use it. It's fast, too, recognising your fingerprint in a fraction of a second, even when your hand is wet.

Six small holes on the BeTouch's bottom edge allow sound to escape from the built-in speaker. It's a preferable approach to a rear-mounted speaker that can fire sound into your palm, although front-facing would be even better.

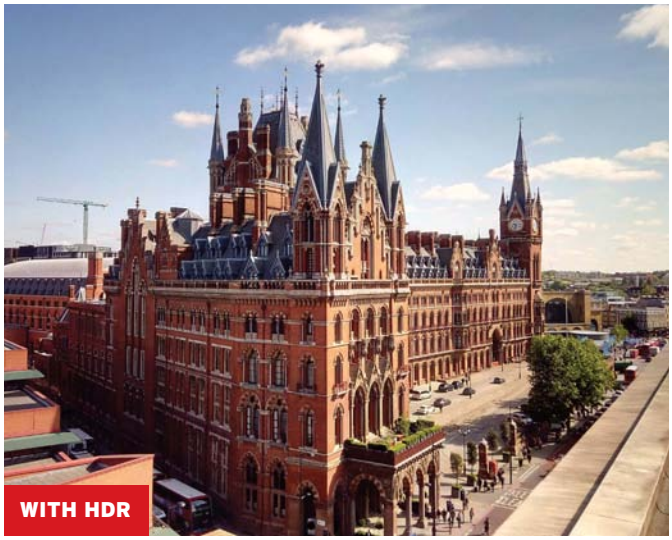
With a 1.7GHz octa-core processor from MediaTek, 3GB of RAM and Mali-T760 MP2 graphics inside, the Ulefone BeTouch is a capable smartphone. In real-world use, we found it very smooth, and this is no doubt thanks to not only the hardware but a lack of bloatware slowing it down.

We ran the Ulefone BeTouch through our usual benchmarks, and the results make for pleasant reading – particularly in Geekbench 3, which measures processor performance. In the multi-core component of this test, the BeTouch scored a staggering 3817 points. And that really is incredibly fast, beaten only by the fastest Android phones we've ever tested, the Samsung Galaxy S6 and S6 Edge. (And the UMI eMax, although the Ulefone shows better performance in other tests.) In the single-core component the Ulefone scored 794 points, which places it in between the UMI eMax and UMI Hammer.

In SunSpider, which measures JavaScript performance, the BeTouch did a good job for an Android phone, with this benchmark's scoreboards dominated by the various iPhone models. We ran SunSpider both on the browser that came preinstalled on the Ulefone, in which it scored 915ms, and in Chrome, which we use to ensure a fair test across all Android phones, in which it scored 975ms. In SunSpider a lower score is better, which means it actually did a better job here than did the aforementioned S6 and S6 Edge.

GFXBench is used to measure graphics performance, and the Ulefone recorded 25fps in T-Rex and 12fps in Manhattan. Both are very good scores for a phone at this price point, and in line with flagship phones such as the LG G4 and Nexus 6.

Two new tests we've recently begun using in the *PC Advisor* lab and for which we currently have few scores to compare are AnTuTu and the battery life test built into





Geekbench 3. In AnTuTu, the BeTouch recorded 41,661 points, which is a little below Ulefone's claims of 45,000 points-plus, and put its performance somewhere between the Samsung Galaxy S5 and Nexus 5.

In Geekbench 3's battery test the Ulefone recorded 2540 points (04:38:40), which is a little behind the LG G4. Arguably, though, even the best phone battery will quickly be drained by a heavy user, so how fast the phone can recharge its flat battery is also important. Using the included charger the BeTouch can reach 35 percent in just 15 minutes. This is a two-pin plug, but Geekbuying will also supply a UK adaptor in the box upon request.

Also pleasing is the fact the Ulefone BeTouch's 2550mAh battery is removable, which means you could carry a spare.

With the exception of NFC, the BeTouch has all connectivity bases covered, with dual-band 802.11ac Wi-Fi, Bluetooth 4.0, GPS, A-GPS and GLONASS and OTG. Plus, not only is it dual-SIM, with one slot supporting a full-size card and the other Micro-SIM, it supports 4G. And, unlike some Chinese phones, wireless updates are available, making it easy to install software updates.

Slapped on the back of the BeTouch is the same 13Mp Sony Exmor IMX214 camera that is found on the rear of many Chinese phones. That's not a bad thing, though, and the photos it takes are much better than you have any right to expect at £150.

The camera is quick to focus once you've launched the app, although a dedicated camera button would make doing so even faster. There's a dual-LED flash and the BeTouch stretches to ISO 1600 for better low-light pictures, while the rear camera also supports up to 4K video recording at 30fps and has a tracking autofocus for capturing moving objects. Around the front is a 5Mp selfie camera with an 80-degree wide-angle lens.

Both cameras support real-time application of filters, plus various modes including picture in picture, live photo, motion tracking, beauty, panorama and multi-angle. You can trigger a shot with a gesture, smile or voice command, although in doing so the camera switches off its anti-shake feature. Face detection is also supported.

HDR is not automatic, but we found photos look better with it turned on (see our test shots above).

The Android Lollipop operating system preinstalled on this phone is exactly as Google intended, and that makes a refreshing change. There is zero bloatware preinstalled, and we found all but one of the shortcuts fit on a single page of the Nexus launcher app tray – amazing.

The only changes Ulefone has made are for the better: there's the aforementioned option to invert screen colours in the Quick settings drop-down, plus you can set custom gestures that allow you to launch an app of your choice from standby simply by drawing a letter on the screen. The ability to wake the screen with a double-tap also eases managing this phablet in a single hand.

Verdict

Ulefone's BeTouch is an unrivalled deal at £147. It's fast, it's dual-SIM with 4G connectivity, it has a working fingerprint scanner for security, the screen is large and with an HD resolution plenty crisp enough for the money, and there is absolutely no bloatware. A few minor quibbles aside, it's genuinely difficult to fault this phone at this price. ☒ **Marie Brewis**



SMARTPHONE

UMI eMax

£115 (plus import duty)

Contact
■ umidigi.com

Specifications
5.5in full-HD (1920x1080, 401ppi) IPS display; Android 4.4 KitKat with Rootjoy; 1.7GHz MediaTek MTK6752 octa-core 64-bit processor; 2GB RAM; 16GB storage, with microSD support up to 64GB; ARM Mali-T760 MP2 GPU; dual-SIM: GSM 850/900/1800/1900MHz, WCDMA 900/1900/2100MHz, 4G-FDD 800/1800/2600MHz; dual-band 802.11b/g/n Wi-Fi; Bluetooth 4.0; OTG; GPS; A-GPS with EPO; HotKnot; 13Mp rear camera with LED flash, f/2.2 aperture, dynamic HDR, 0.3s fast autofocus and six-piece lens; 5Mp front camera, f/2.2 aperture, 1.12um pixel size; 3780mAh non-removable battery; 152.3x7.9x76.5mm; 148g

Build: ★★★★☆
Features: ★★★★☆
Performance: ★★★★½
Value: ★★★★½

★★★★☆

We've been impressed by what we've seen from Chinese phone maker UMI so far, having recently reviewed both the Zero and Hammer. This UMI eMax is an altogether more powerful beast, with an octa-core processor, a standout 5.5in full-HD screen and a massive 3780mAh battery that can even serve as a power bank for other phones.

The best bit about the UMI eMax is its price, and right now it's available for just £115 from Coolicool.com. That's amazing value for money. Bear in mind, though, that this phone ships from China, so you may also incur import duty when purchased in the UK.

Unlike the Zero and Hammer before it, the UMI eMax is a relatively plain-looking, unassuming device. With a 5.5in screen this is a phablet, but it's still just 148g and with slim bezels reasonably easy to operate in a single hand.

From the front, the phone is marred only by the always-visible legends for the Home, Back and Options buttons. Switch on the screen, though, and you instantly don't care: with a full-HD resolution this IPS panel is crystal clear, and as sharp as many flagship Androids at 401ppi. You absolutely should not expect a full-HD screen at this price. Colours are bright and realistic, even with the brightness turned down, and viewing angles are very good.

From the rear, the eMax is less attractive, but by no means ugly. We're confused by the Chinese-English translation in the eMax's marketing materials, which states: "The one piece art of frame battery cover is made by Polycarbonate with 200 times processing brushed stainless steal [sic]." This phone looks and feels very much like a plastic device to us, although there is a subtle brushed-metal effect to the rear.

The rear cover is non-removable, with side-loading trays for the two SIM slots and microSD card. A power button and volume rocker are also found on the eMax's right side, while there's a headphone jack at the top and Micro-USB charging port at the bottom. Despite its plastic feel the eMax feels very sturdy – not as tough as the Hammer, but tough nonetheless.



We're not so keen on the way the phone's 13Mp camera sticks out at the rear, but this is becoming increasingly common in today's ever-thinner phones. And this is one of them: at 7.9mm thick, you'd never guess the eMax costs just £115. As is the case on the Samsung Galaxy S6, though, this camera is centred and squareish, so it won't rock nearly so much when placed flat on the table as, for example, the iPhone 6.

Also at the base of the rear is a speaker grille. Usually this is a no-no for us, muffling sound as it fires it into your palm, but this phone's phablet dimensions stopped this being a problem in our testing.

Hardware and performance

Inside the eMax is a 1.7GHz MediaTek MTK6752 octa-core 64-bit processor, 2GB of RAM, 16GB of storage and an ARM Mali-T760 MP2 graphics processor. We have seen this setup before, such as in the Kingzone Z1, while the Ulefone BeTouch (page 36) adds an extra gig of RAM. But the eMax appears to have put its hardware to the best use – at least if our benchmarks are to be believed.

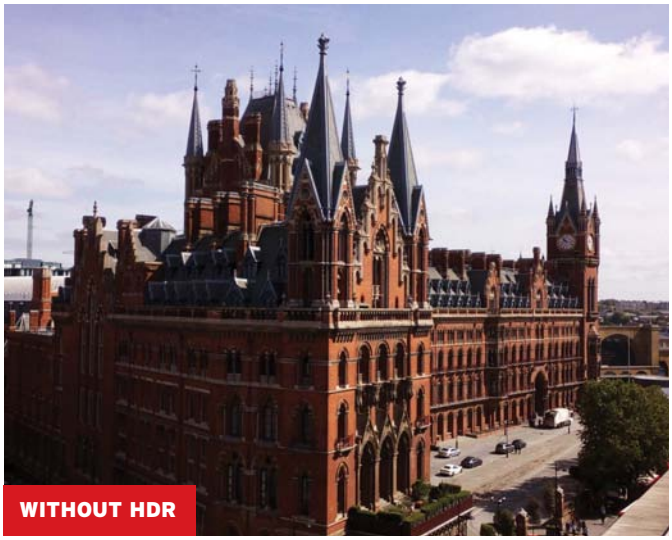
And therein lies the catch: benchmarks can't always be trusted. Nevertheless, we found the UMI eMax smooth and responsive in real-world use, with no sign of lag.

In Geekbench 3.0, the eMax gave its standout performance. We use this test to measure processing performance, but have also recently begun including results from its battery life test. The eMax aced both – and the latter is certainly no surprise, given the capacious 3780mAh cell found inside. With OTG support (and an adaptor included in the box), the eMax can even be used as a power bank to charge another phone – it will fill an iPhone 6 twice, says UMI. So, you can expect several days' life with normal use.

The reigning champions of our Geekbench 3 tests are the Samsung Galaxy S6 and S6 Edge, with the S6 scoring 4438 points in processing- and 4136 in battery performance, and the S6 Edge 5076- and 4011 points. The UMI eMax got incredibly close to those scores performance, with 4101 points in processing-, and 4006 in battery performance. By comparison, in processing performance the UMI Hammer recorded 2203 points and the Kingzone Z1 3689. We also ran the Kingzone through the battery life test, and it scored 3074 points.

AnTuTu is another new test to the *PC Advisor* lab, and with few results with which to compare devices for now it's rather difficult to understand what the scores are telling us. However, through AnTuTu's own database we can see that the UMI eMax's 41,799-point score is faster than both the Nexus 5 and LG G3, but slightly below last year's flagship Samsung Galaxy S5. It also performed better than the UMI Hammer (32,506) and Ulefone BeTouch (41,661).





Graphics performance in GFXBench showed something to be desired, and rather than delivering scores to match the flagships the UMI eMax put in a performance similar to that of other budget- and mid-range phones, including the EE Harrier, Sony Xperia M2 and Moto E 4G. Casual games will be easily playable on the eMax, but scores of 15fps in T-Rex and 6fps in Manhattan are nothing to shout home about.

Our final test is SunSpider, which measures JavaScript performance. We ran this test both in the preinstalled browser, in which it recorded a very good 734ms, and in Chrome to ensure a fair test across Android phones. Its Chrome score of 840ms is still very good (lower scores are better), and in line with the likes of the Honor 6, Sony Xperia Z3 and Samsung Galaxy S5.

Connectivity

Connectivity-wise there's support for dual-band 802.11b/g/n Wi-Fi and Bluetooth 4.0. For positioning, you get both GPS and A-GPS with EPO, with the separate GPS sensor claimed to offer faster results and improved accuracy.

NFC is missing, but you do get HotKnot, which is MediaTek's equivalent. This lets you share files and web pages, play games and more with other HotKnot-connected phones.

OTG support is perhaps more useful in the UMI eMax than it is other Androids, given the large-capacity battery. You could even use the eMax as an emergency charger for powering other devices. OTG also lets you hook up external storage devices, and an adaptor is handily supplied in the box.

The UMI eMax is a dual-SIM phone that operates in dual-standby mode, accepting two Micro-SIMs. It's a 4G phone, which is very good at this price, but if you're buying the eMax in the UK, check that it will work on your network first. The eMax operates on GSM 850/900/1800/1900MHz, WCDMA 900/1900/2100MHz and 4G-FDD 800/1800/2600MHz.

Cameras

As with virtually every Chinese phone we see, the UMI is fitted with a 13Mp camera at the rear, with f/2.2 aperture and an LED flash, and a 5Mp selfie camera with f/2.2 aperture and 1.12um pixels.

The primary camera focuses in 0.3 seconds, and we found it did a decent enough job when we switched on HDR, although some detail is missing when you zoom in. You can see our test shots with and without HDR above.

Real-time filters are available at the composition stage for both cameras, and both also benefit from a Beauty mode and Picture-in-picture. Switch to the main camera and you get more options, including HDR, live photo, motion tracking, panorama and multi-angle capture. There's support for smile-, gesture, and voice-activated capture, too, plus a 40-shot burst mode.

Note, however, that the full 13Mp is available only in 4:3 format; in the phone's default 16:9 stills top out at 9.5Mp.

We also tested the video camera. Playback was fine on the phone, but developed a stutter when we downloaded it to our computer.

Given that the UMI eMax is sold rooted and with support for Rootjoy, there's no need to stick with the Android 4.4 KitKat OS preinstalled out of the box unless you want to. An upgrade to Lollipop is available, or you can load up Rootjoy on a Windows PC or laptop, hook up your phone and then install a custom OS of your choice. Rootjoy also lets you load updates, install a custom UI and back up your data.

Stick with KitKat, though, and you won't be disappointed. This is a stock implementation of the Android operating system, with full access to Google Play and Google apps. Very little bloatware is preinstalled, and you may find additional apps such as ToDo and File Manager useful. SuperCleaner's effect is debatable, but it aims to clear away junk files, help you manage your apps and startup items and more to boost performance.

In common with the majority of Chinese phones we review, customisable gestures are present. Not only can you double-tap to wake the screen, but you can draw a letter onscreen in standby mode to automatically launch an app of your choice. The sooner this becomes a standard feature of Android, the better.

Verdict

The eMax offers superb value for money. It's not as good-looking as other UMI phones we've reviewed, but it has a big and bright full-HD screen for enjoying media and more, and showed very capable performance in the majority of our benchmarks. Photography is decent at this price, and enthusiasts will appreciate the Rootjoy support. At £115, you can't go far wrong with the UMI eMax. ☒ **Marie Brewis**

SMARTWATCH

LG Watch Urbane

£259 inc VAT

Contact
■ lg.com/uk

Specifications
Android Wear; 1.2GHz Qualcomm Snapdragon 400; 4GB storage; 512MB RAM; Wi-Fi; Bluetooth 4.1 LE; 1.3in POLED screen (320x320, 245ppi); Voice mic; stainless steel cover; genuine leather strap; Corning Gorilla Glass 3; 410mAh battery; IP67-rated; 46x52x10.9mm; 67g

Build:
Features:
Performance:
Value:



With its design and build superior to most Android Wear smartwatches, the LG Watch Urbane fetches a higher price. While most cost between £150 and £200, the Urbane will set you back £259, although it's still cheaper than the entry-level Apple Watch, which costs £299.

Looking very much like its predecessor, the G Watch R, the Urbane has been upgraded to a full metal casing, and is available in a silver option and a more blingtastic gold.

A watch like this is supposed to be big and heavy, and if that's what you're looking for then great, but some may find this device too bulky and unwieldy for their wrist. Weighing 67g and measuring 46x52x10.9mm, the Urbane is hardly svelte, though it's thinner than the G Watch R because it doesn't have the dished bezel around the screen.

The silver model comes with a black leather strap, while the gold option is paired with a brown strap. You can swap them out for any strap with 22mm pins, which is handy. As expected, the leather is stiff at first but softens over time making it more comfortable.

Like its sort of predecessor, the Urbane has an IP67-rated design meaning it's waterproof. LG warns that you shouldn't keep it submerged longer than 30 minutes though, or take it to a depth greater than 1m.

The design is the big change here when compared to the G Watch R. The hardware and specs remain the same, so you'll get a 1.3in (320x320) P-OLED screen, a Qualcomm Snapdragon 400 processor and 4GB of internal storage.

The screen is crisp and has decent brightness, so you can read it easily indoors and out. However, you'll probably want to switch the always-on feature to save battery since there's no ambient light sensor for automatically adjusting brightness.

There's also 512MB of RAM, the same heart-rate monitor on the underside and other sensors including a barometer, accelerometer and compass. The Watch Urbane lacks GPS, though. As with other heart-rate monitors on watches, taking a reading is very much hit-and-miss, so you often need to press the watch firmly on to your skin to help it out.

A big new addition is built-in Wi-Fi, which means you can still use the Watch Urbane even without having it connected to a companion device – minus any phone-specific notifications such as calls and text messages, of course. You can select this option when setting up the watch with the Android Wear app.

The 410mAh battery is the same size as that found in the G Watch R and is charged via a magnetic dock – that's why there are five circular metal contacts on the rear. In terms of battery life, you'll get just over a day, but if you turn off the 'always-on' function, then the screen will consume less power and you'll get a couple of days from the Watch Urbane if your usage is light.



As well as Wi-Fi connectivity, the Watch Urbane has more tricks up its sleeve thanks to the recent Android Wear update. The menu is now split into three sections, which contain apps, contacts and available commands. It's a welcome change and makes using the operating system a lot easier than previously.

The apps menu will display recently used ones at the top, but don't get too excited about the LG Call apps because the watch doesn't have a speaker so it's just for initiating a call on your connected phone.

Verdict

There's a lot to like about the LG Watch Urbane with it's Wi-Fi connectivity and the new version of Android Wear. Since in essence, it's the same device as the G Watch R in terms of hardware, your purchase hinges on the design. It's expensive and bulky, and we can't see it appearing to the masses, so the G Watch R is still our recommended choice. ☒ **Chris Martin**

HANDHELD GAMES CONSOLE

Nintendo 3DS

£149 inc VAT

Contact
■ nintendo.co.uk

Specifications
Lower screen, 3.33in (320x240) touchscreen LCD; 253g Upper screen, 3.88in (800x240); 0.3Mp resolution cameras; Wi-Fi; stereo speakers; infrared communication; NFC; microSD slot; AC adaptor; audio jack 80.6x142x21.6mm (when closed); 253g

Build: ★★★★½
Features: ★★★★½
Performance: ★★★★☆
Value: ★★★½☆
★★★★½



The new 3DS might not look too different from its predecessor at first glance, but several small hardware changes make this hand-held gaming console everything the original 3DS should have been.

When we first picked up the new console, which Nintendo says has 3D face tracking to help improve the 3D experience, we were dubious. This feature worked on the original 3DS only if you sat directly in front of the device. Within seconds, however, we found ourselves cranking the 3D slider up to maximum. It's fantastic.

The 3D improvements have been made possible thanks to the introduction of a tiny camera next to the main front-facing camera, which tracks where your face is and adjusts the image accordingly.

The second of the main changes is the introduction of the C Stick and two new buttons: ZL and ZR. Many gamers have been crying out for a second joystick on the 3DS, particularly for games that require you to rotate the screen in addition to moving your character – it can get tiresome having to reposition your hand to use the touchscreen for screen rotation, that's for sure.

Nintendo offered a solution for owners of the original 3DS in the form of the Circle Pad Pro, an attachment that added a second joystick and two additional buttons, but also added bulk and weight to the otherwise super-portable device, so it's less than ideal.

The new 3DS, however, has a tiny C Stick built in, something we wish Nintendo had thought of four years ago when the 3DS came out.

The ZL and ZR buttons, which you'll find fall beneath your index fingers beside the already present L and R buttons, are another extra that isn't particularly useful right now, but we imagine that when developers begin integrating the buttons into their games they could be a real boon and offer further control and gameplay features.



Performance

The new 3DS is much faster than its predecessor. Opening and closing apps is now incredibly fast. That's thanks to improved CPU performance, which means loading times have been reduced, too. What's more, Nintendo says that "several upcoming games" will be built from scratch specifically for the new 3DS to take advantage of the power boost it's been given.

Nintendo has also updated the 3DS's web browser to allow for a better browsing experience when using the internet. You'll be able to use the ZL/ZR buttons to switch tabs, and use the C Stick to zoom in on pages, which we found to be intuitive.

The original 3DS' camera isn't brilliant and nor is the new console's offering, though it has been slightly improved for photos in low-light conditions. There's a camera on the front of the device for 2D images, or you can capture 3D images viewable on the device's display using the dual rear-facing cameras.

The device now has NFC built in, which means you'll be able to play with Amiibo figures on your 3DS as well as your Wii U, simply by placing the figure on the lower 3DS display. These figures work with various different games to help you add new characters or customise them, get special bonuses, level up characters and more. The number of compatible games is growing, with Super Smash Bros for 3DS and Xenoblade Chronicles 3D set to arrive soon.

Aside from the aforementioned new buttons and C Stick, the overall design of the 3DS is in essence the same. There are two models available: the 3DS with a 3.53in top display and a 3.02in bottom display, and the 3DS XL (priced £179), which is slightly less portable but offers bigger screens at 4.88in and 4.18in, so arguably a better experience overall.

The 3DS is available in white or black. There are also replaceable cover plates available to allow you to completely customise your device.

The other slight difference between the original 3DS and the new model is the coloured buttons, repositioned game slot, stylus and volume slider, and repositioned Start and Select buttons.

Verdict

If you consider the new 3DS's price from a broader perspective, taking into consideration the price of other games consoles, it does seem a bit pricey. You can buy the Sony PS Vita (2014 edition) for around £150, and even the Nintendo Wii U for £160. For most gamers, though, its value lies in the games available, so for Monster Hunter fans, Pokémon fans or fans of Nintendo's many classics, paying the £150 or £180 for the new 3DS is a no-brainer.

☒ **Ashleigh Allsopp**

SPEAKER

Raumfeld One S

£199 inc VAT

Contact
■ raumfield.com/uk

Specifications
90mm mid-woofer; 20mm tweeter; 2x 95mm passive bass radiators; 2x Class-D amplifiers; ethernet port; USB port; Spotify compatible; Tidal compatible; TuneIn Radio compatible; 180x130x110mm; 1.4kg

Build: ★★★★½
Features: ★★★★☆
Performance: ★★★★☆
Value: ★★★★☆
★★★★☆



Raumfeld is an audio brand that you might not have heard of before, but it's now owned by the long running German loudspeaker specialist, Teufel. Whether you've heard of either, Raumfeld products are now easily available in the UK and we've taken a look at the firm's pint-sized multi-room speaker.

Although the Raumfeld One S is small, that doesn't mean it's cheap. This little speaker will set you back £199, although it's the most budget of the brand's wireless speaker line-up. You might want to make a stereo pair with two and you can save £50 if you buy this way.

The price, size and features mean that the One S has some tough competition in the ever expanding multi-room audio market. Sonos is recognised widely as one of the leading brands and is something of a benchmark. Its latest speaker – the Play:1 – costs £169 and is a fantastic little speaker, so let's see whether it's worth paying extra for the One S.

Like the Sonos range, the Raumfeld is available in black or white, with the latter being the company's classic option. The design is square and industrial with straight lines, which is different from Sonos' approach but may fit in better with the style of your home.

The One S measures just 18cm wide and weighs 1.4kg, so if space is limited, then it's well suited to squeezing into narrow and tight gaps. We like the simplistic appearance with the fabric wrapping around to the sides. The build quality is excellent and there are some nice details such as the spun finish on the power button.

A major advantage of the One S is that's it's designed to work in bathrooms and kitchens thanks to a humidity resistant design. A rubber cover seals all the physical ports on the rear, although you won't be able to use any apart from the power cable when this is attached.

There's an ethernet port that is partly for set up, but you can use it for connectivity if you like. There's also a USB port, but it's downward facing which is something of a design flaw since there's not enough room for a normal sized flash drive.

Like other multiroom systems, you can simply start by buying one speaker and adding more as and when you choose (or can afford to). If you have more than one Raumfeld speaker, you can place them in different rooms around your house and choose what music to play on each – or synchronise them to play the same tunes.

We found that the system works well, and you can control everything with the free app for iOS and Android. The app is decent but not a patch on the polished Sonos app. It's intuitive to use and we like the virtual volume dial and the addition of an EQ, even if it is limited to simple bass, mid and treble sliders.

There are physical buttons on the top of the Raumfeld One S, which are under a rubber cover (to keep any moisture out if you're using it in a bathroom or kitchen). You've got volume control as you would expect and four other buttons simply labelled 1 to 4. These work like a car stereo and allow you to create pre-sets. Long pressing one while listening to a radio station, album or playlist will assign it then in future you can just press the button to start it up. It's a shame not to have play/pause or skip buttons, though.

Whether you connect your One S to the network via ethernet or Wi-Fi, you can stream music from various different sources including computers on your network or the device you have the Raumfeld app installed on. It's much more clunky than Sonos, but works.

It's easy to listen to radio stations with TuneIn, but things are somewhat limited when it comes to other services with just Spotify and Tidal available, both require subscriptions. This means, to name a few, Amazon Music, Google Play Music and Deezer are all missing.

If you're happy with Spotify and/or Tidal, then the sound quality of the One S is very good. Although Teufel has been making loudspeakers for decades, the speaker uses a Class D amp, which is a shame but also not a surprise.

The One S uses a two-way coax system with a 90mm mid-range driver and a 25mm tweeter. These are joined by side-mounted 95mm passive bass radiators (one on either side). The result is well-rounded and suits the vast majority of music genres but sounds muddy at times.

With the two Class D amps output a maximum of 40W RMS, and we were impressed with how loud you can pump the One S without losing sound quality and introducing distortion. Even with a lower quality radio stream, you'll won't believe the sound is coming from this tiny box. Pairing two speakers into a stereo pair creates a huge sound stage.

With the EQ you can tweak the sound to suit your taste, the room your in or the music you're listening to, but most of the time we found little need. The mid and bass frequencies tend to dominate at default settings, so we recommend boosting the treble a little.

Verdict

The Raumfeld One S is impressive with its sleek design and decent sound performance. Preset buttons are handy and the humidity resistant design make it perfect for the kitchen. However, it's more expensive than the Play:1, lacks some music services and the app could be improved. ☒ **Chris Martin**

POWERLINE ADAPTOR

TP-Link 300Mb/s AV500 Wi-Fi Powerline Extender



£89 inc VAT

Contact
■ uk.tp-link.com

Specifications
Base unit has two 10/100 ethernet ports, secondary adaptor has one; claimed 300Mb/s Wi-Fi speed

Build: ★★★★½
Features: ★★★★½
Performance: ★★★★☆
Value: ★★★½☆

The TP-Link 300Mb/s AV500 Wi-Fi Powerline Extender is a neat starter kit of Powerline adaptors that both give you near-ethernet speeds in rooms away from your internet router and create a second Wi-Fi hotspot in your home.

It consists of two adaptors. The base unit is one of the smallest we've seen. This is the one you plug into a power socket near your router and connect to the router with one of the two supplied ethernet cables.

The second adaptor is a little larger, but by no means chunky. It's located in the second room where you want to connect devices such as smart TVs, games consoles, Sky+, Tivo, Apple TV and other set-top boxes. These can be connected using the other ethernet cable or via the new Wi-Fi hotspot it creates in the room – handy for laptop, smartphone and tablet users.

The second ethernet port on the Wi-Fi adaptor is welcome as many homes now have more than one device that requires fast internet access. The ethernet ports and cables are rated 10/100, so like most Powerline adaptors, the AV500 was never going to beat 100Mb/s in the first place. TP-Link isn't alone in over-claiming network speeds, and much depends on your home set up.

We tested the AV500 in a Victorian house with old wiring and the usual array of electronic devices (TV, Sky+, hi-fi, lamps, computers, and so on) plugged into the power lines. The internet router was situated in the office on the second floor, and we used Powerline to test data speed on the ground floor.

First, we must emphasise that despite TP-Link's claims of speeds of 300Mb/s these are theoretical maximums, and you will never see such speeds via Powerline. Indeed, you'll be lucky to get 100Mb/s. But don't fret as this is fine for most needs, such as watching catch-up TV or downloading large files.

We recorded speeds of up to 92Mb/s, though the house average was 68Mb/s using Powerline and ethernet. This was one of the faster average speeds we've achieved from a powerline adaptor, and is sufficient for most users, and we downloaded HD TV with few pauses.

When we tested the second Wi-Fi hotspot we got speeds of 57Mb/s, which again were above average.

Verdict

The TP-Link AV500 is one of the fastest sets of Powerline adaptors we tested. It's not too big but offers both Wi-Fi and more than one ethernet port. ☒ **Simon Jary**

HEADPHONES

RHA MA750i



£89 inc VAT

Contact
■ rha-audio.com/uk

Specifications
Frequency response: 16- to 22,000Hz; nominal impedance: 16 ohms; sensitivity: 100dB; three-button in-line remote and microphone; 10x pairs of ear tips; carry case; 1.35m cable; driver enclosure made from 303-grade stainless steel

Build: ★★★★½
Features: ★★★★☆
Performance: ★★★½☆
Value: ★★★½☆

RHA impressed us with its budget MA450i headphones that punched above their weight for sound quality. The MA750is are almost twice the price, taking RHA well out of budget territory, but again you get a lot for your money.

You can feel the quality the instant you unwrap the thick, heavyweight 1.35m cable from its home in the box. The stainless steel driver housing is similarly strong and heavy, plus the gold-plated 3.5mm connector has a spring to help prevent cable damage.

The drivers are handmade, say RHA, and there's no doubting the stylish, purposeful design. We'd far rather be seen with the MA750i than some of garish cans out there.

In the box, you get a metal holder and zip case for the 10 pairs of tips. This is a lot more than you usually see, and should ensure you can get the ideal fit for your ears. Most are silicone, but there are two pairs of memory foam tips, so you'll have to try them to see which suits you best.

Like some high-end headphones, the MA750is have moulded cables that are shaped to be looped over the top of your ears to help prevent the extra weight pulling the tips out. Some people find this fiddly and less comfortable than standard in-ear headphones, so it's something to consider before buying. We quickly got used to it, but note that the slider to keep the wires together can only go up as far as the bottom of the remote control, so you can't hold the wires in place behind your head as with Shure's. Not that you're likely to be using the MA750i live on stage, but it's worth knowing.

As with a new pair of shoes, you have to use the MA750i for a while to get used to them. For example, bass is dependent on using tips that are a snug fit for your ears. This applies to most in-ear headphones, but it's especially noticeable with these. Unless there's a good seal, you won't hear any bass.

But even with the best-fitting tips, bass isn't that powerful. It's clear and well-defined, but if you're after the kind of punch you get with Beats, you're certainly looking in the wrong place.

Theses headphones are all about flat response, so no frequency overpowers any other. Because of this, sound quality is fairly neutral, and that's exactly what you want if you're after reference sound on a budget.

Verdict

We like the MA750i, which are well made and offer great clarity. We'd prefer more bass, but that would go against the natural sound reproduction that RHA has striven for with these headphones. ☒ **Jim Martin**

BLUETOOTH HEADPHONES

Creative Sound Blaster JAM

£39 inc VAT

Contact
■ uk.creative.com

Specifications
Ultra lightweight, with soft ear cushions for long listening comfort; 32mm neodymium drivers; hidden omni-direction microphone for good voice pick up; Bluetooth 4.1; SBC; FastStream Bluetooth Profiles: A2DP (Wireless Stereo Bluetooth); Bluetooth remote control; 150x65x170mm; 109g

Build: ★★★★☆
Features: ★★★★☆
Performance: ★★★★☆
Value: ★★★★★

★★★★☆

A pair of wireless headphones will liberate you from trailing headphones and getting yanked back when they catch a door handle or any other protruding object. If you've ever pulled the cables too hard and broken your precious headphones you'll appreciate the freedom of Bluetooth audio. There are compromises on sound quality, so it's important to select the right headphones if you value your audio.

Often price is an indicator, and at less than £40, the Sound Blaster JAMs suggest that sound quality won't be great. Our initial concerns were unfounded though, because audio quality was very good. Indeed, it wasn't a million miles from our favourite Bluetooth headphones, the £125 Sennheiser MM 400-X.

The Creatives offer good overall tonal balance, with enough weight in the bass to give a comfortable full sound. There is a slight roughness in the treble, but without overly exaggerated treble that would otherwise make them too wearing.

We hardly expected these headphones to be the last word in detail, but at this price, it's excellent. Its neodymium drivers can handle frequency response of 20Hz to 20kHz. The level midrange means vocals are neither recessed nor pushed up too loud, and these fast and dynamic headphones have an excellent wide stereo with natural spread between the ears.

Overall, these are very impressive as budget headphones, let alone as wireless models using the most basic lossy audio codec.

We are fans of the ergonomics, too. Weighing just 109g, the JAMs are lightweight, and don't clamp too tightly yet feel secure in place – sitting well on the ears. We prefer headphones that will fold up to as small a size as possible, and these don't do that – although they're small enough to fit in a coat pocket or take up little space in a bag.



Built into the right earcup are the main controls for the headset power, volume, Bluetooth connection, audio play/pause and calls. You can also boost the bass by tapping the Bass button on the earcup.

You can also attach the headphones to a PC/Mac via USB for enhanced sound quality – handy when watching a movie or TV programme on your laptop. When paired to a phone via Bluetooth, the built-in microphone blocks out some of the ambient noise and echo.

The Sound Blaster JAM features Near Field Communication (NFC) wireless connectivity for easy one-touch pairing – although this isn't yet supported on iPods or iPhones.

Battery life is another factor to consider when buying Bluetooth headphones, and the Sound Blasters lasted a decent length of time before requiring recharging, which is done using the included Micro-USB cable.



Verdict

The Creative Sound Blaster JAM Bluetooth headphones offer fantastic value for money as they outperform expectations on both audio quality and comfort. Incredibly lightweight, you'll hardly notice you're wearing them, and while they don't fold for ultra portability they are small enough to fit in a coat pocket. ☒ **Simon Jary**

POWER BANK

Emie Power Note 5200mAh

$54 (£35)

Contact
■ nathanrd.com

Specifications
5200mAh lithium-polymer power bank; 10W (5V, 2A) Micro-USB input; 12W (5V, 2.4A) USB output, plus built-in Micro-USB cable with 12W (5V, 2.4A) output; max total output 12W (5V, 2.4A); passthrough charging; four LEDs denote power status; no auto-on/-off; no carry case; 170x95x7mm; 200g; six-month warranty

Build:
Features:
Performance:
Value:



If you're a student or you carry a ringbinder for work, its built-in binder holes and Micro-USB cable make the Power Note an ideal device for easy charging on the go. This 5200mAh power bank is also slim and lightweight, with an aluminium chassis that is reassuringly tough and does a great job of dissipating heat.

The Power Note ships in its own little ringbinder, and its user manual is held in place by the clipped-in power bank. Even if you don't use a ringbinder, the ultra-slim (7mm) power bank will slip easily into a laptop bag or handbag, and it's tough enough that no carry case is required to protect it.

Our review sample came in black with orange accents; the Power Note is also available in blue and orange or white and orange. Better suited to Android- and Windows Phone users than iOS fans, an orange built-in Micro-USB cable runs neatly up the right edge and clips securely into the side, so you don't need the hassle of carrying additional cables.

If you are using an iPad or iPhone, a USB output lets you attach your own Lightning cable. Note, however, that the Emie's max output is 12W, so with both outputs engaged neither will run at full power.

Whether you use the USB output or built-in cable, the Power Note can output 12W to charge your attached phone or tablet. That's plenty for even the fussiest tablets, and will ensure as quick a charge as the device can handle.

Don't expect to have 5200mAh of power to charge your devices, mind. Most power banks average around 70 percent efficiency, with some power lost through voltage conversion and heat generated. In such a circumstance, you may find only around 3640mAh available, which for most Android phones is a little over one full charge.

When the Emie runs out of juice a USB cable is included in the box for refilling it. You simply attach one end to your phone or tablet charger, and the other to the Micro-USB input on the device's bottom. How quick the Emie charges depends on your adaptor, but with a 10W input it should be reasonably fast.

So how do you know when the battery is empty? We've expressed our dislike of LED status indicators in power banks before, much preferring an LCD for an exact readout, but at 5200mAh four LEDs are sufficient for telling you at a glance how much power remains. These will activate when you push the small button beside them, which is also used to begin charging.

Verdict

We love the Emie Power Note. It offers fast charging and a handy built-in Micro-USB cable, too, meaning you can leave the cable clutter at home. ☒ **Marie Brewis**

POWER BANK

Emie Power Blade 8000mAh

$79 (£51)

Contact
■ nathanrd.com

Specifications
Frequency response: 16- to 22,000Hz; nominal impedance: 16 ohms; sensitivity: 100dB; three-button in-line remote and microphone; 10x pairs of ear tips; carry case; 1.35m cable; driver enclosure made from 303-grade stainless steel

Build:
Features:
Performance:
Value:



We were in awe of the Power Note's premium aluminium alloy design, with its unique binder holes along one edge of the ultra-slim power bank used to effortlessly secure it into a ringbinder, and its handy built-in Micro-USB cable (see above). The Power Blade features those same binder holes along its left edge, and while it lacks the built-in cable you do get a felt case for protecting it on the road. A handy front pocket lets you also carry the supplied Micro-USB cable, along with a pair of headphones or whatever you like.

The Power Note is slim at just 7mm, but Emie claims the Power Blade is the slimmest power bank in the world at just 5.2mm. It's a little larger than the Note, given the increased capacity available, but it's remarkable how Emie has achieved such a thin-and-light design.

To connect a USB cable, you must first push forward the top edge of the USB output to slide out the metal casing and enlarge the port. Both USB outputs are specified at 10.5W (5V, 2.1A) for fast charging of your connected devices, and the Power Blade offers adaptive charging with one port optimised for iOS devices and the other for Android and other devices.

With 8000mAh on offer, and an average efficiency rate of 70 percent for most power banks, expect to find at least 5600mAh available for charging your phone or tablet. That would provide our Samsung Galaxy S6 (2550mAh battery) two full charges with some power to spare.

Four LEDs are activated at the press of the small power button to show you how much juice remains. When the power bank is empty, the Emie can refill its own battery at 10W (5V, 2A), given a compatible charger (you can use whichever adaptor came with your phone or tablet). We found the Power Blade was able to simultaneously charge itself and a connected device.

In passthrough charging mode, we needed to press the power button to begin charging our S6, but when the Emie was not connected to the mains, it was a case of plugging in the device and the Power Blade sprang into action. However, while there is auto-on, there is no auto-off. You'll need to unplug your phone or tablet once charging has finished to ensure no power is wasted. This small power button can also be held down for three seconds to put the Emie into adaptive charging mode.

Verdict

The Power Blade is expensive for an 8000mAh power bank, but we think it's worth the outlay with a unique thin-and-light design, dual-output adaptive charging and high-end features such as passthrough charging. ☒ **Marie Brewis**

GAME

Project CARS

£38 inc VAT

Contact
■ slightlymadstudios.com

Specifications
Available for PlayStation 4, Xbox One, Wii U and PC; 60 tracks; dynamic time and weather system; 60fps



Project CARS is a driving game for PS4, Xbox One, Wii U and PC that had a very interesting development process – it was crowdfunded by gamers and driving fans. Slightly Mad Studios, the developers of the game let backers decide highly important aspects of the game including the cars and tracks. The result? A highly diverse driving simulator that stands separate from the likes of The Crew.

Though referred to as a game, we'd class Project CARS as more of a racing simulator. Why? Because games usually include some kind of story mode where you unlock cars, parts or new tracks – Project CARS doesn't have this. There are no car upgrades, unlocks, story line or extras for doing a race particularly well, much to our disappointment. We like to notice progression when playing a game, and while this is evident by moving up in classes, this isn't earned – you can join any racing class, even if you've just started playing for the first time.

There are four racing modes: Solo Race, Online, Career and Driver Network. The Solo Race is where you have complete freedom over the conditions of the race – you choose the car, track, restrictions, settings and even the weather conditions. It's where you can practice with any car and is where you can really hone your driving skills.

Online is where you'll be facing real-life opponents from around the world. It brings a whole new aspect of gameplay as you have to look at what cars your competitors have selected and decide what can keep up (or beat) them. But it's not just about speed – you have to take into consideration other things including how many turns there are, how long the course is and even the current weather.

The only frustrating part of the online experience is, oddly, the other players. For those of us that like to play racing games properly and enjoy the precision of racing, having someone ram into the side of you to cause you to spin out and loose your lead is incredibly frustrating. It doesn't happen with every race, but it's rage inducing when it does.

Career mode is where you assume the role of a racing driver looking to progress throughout the ranks of motor racing. The mode is classed as a 'career', and one would assume that means starting from the bottom and working your way up, but instead Project CARS lets you select whatever class of racing you want from the get go. There is progression as you move up from the selected tier after winning championships and unlocking new contracts, but we're not too sure if we like the idea behind this.

As you'd imagine, the better the class, the more fun the cars are to drive. It's also true of the opponents in our experience – lower class AI drivers seem to be extra sluggish, with one of our wins coming with a 30-second lead without adjusting the AI difficulty. It shouldn't be as easy as it was either, as we rarely saw another competitor once we reached first place. It's only after you progress through the various vehicle classes that the AI becomes more challenging.

The Driver Network is where you can get an overview of your Project CARS activity, including your performance in races and your online reputation. If you've saved any photos or replays during races, this is where you can find and share them. The best part is the Time Trials, as the network stores both the lap record for every player on every track and the ghost data that details how they achieved it. This is then used in time trials, meaning you can race a player's 'ghost' to improve your own lap time.

Tracks

As we mentioned earlier, backers of the simulator had a huge say in certain elements, including which courses would be featured in Project CARS. It has over 60 courses, including popular UK courses Cadwell Park, Donington, Snetterton, Oulton Park, Brands Hatch and, of course, Silverstone. Many tracks also have alternate race layouts that bring new challenges to courses you may know well.

One aspect of Project CARS that everyone mentions is graphics. We were teased with a series of beautiful clips and screenshots prior to the release, depicting beautifully high definition cars and the most realistic weather system we'd ever seen in a game. This got us very excited to go hands on, but when we did we were met with an overwhelming feeling of disappointing. Don't get us wrong, the graphics are far from terrible, but they're far away from what was shown prior to its release.

You can tell that a lot of work has gone into the car models, as they're hands down the best-looking element of the simulator. It's a shame that this level of attention to detail wasn't applied to the tracks, as we noticed that certain elements of tracks were surprisingly low-res as we drove around them. We know that many people won't pay attention to background models like trees and bushes, but we think it makes a difference whether they are pixellated or not.

The in-car POV view is a favourite of racing-sim fans, so it was important for Slightly Mad Studios to get it just right. We think the developers hit the nail on the head with the in-car graphics, as every dial is responsive, mirrors actually show you what's behind you (unlike other driving games where it's blurred) and you can appreciate the level of detail available.

However, we noticed that the graphics varied between consoles – the PS4's graphics were acceptable, but those produced by the PC version were much better. There are reasons behind this, mainly down to

hardware as PCs can usually handle much more than the 'next-gen' PS4 and Xbox One.

There is one impressive aspect with regards to graphics – the dynamic weather system. Though, like the car graphics, it looks nothing like the teaser we saw, but it's still done beautifully well.

We've started off a race in a torrential downpour (which makes corners tricky), but as the race progressed, you could see the rain receding and it was soon replaced with sunshine. The most impressive part was that when it was raining, we couldn't see a thing and had to put the windscreen wipers on (we were using the POV camera angle) – it adds an extra level of realism to the simulator, further backing up the simulator vs game argument.

However it's not as dynamic as the DriveClub weather system, which takes into consideration how rain droplets react with the cars movement, speed and force – Project CARS doesn't do this. You can even see individual droplets running down the car in DriveClub, which is amazing.

Sunsets look gorgeous, especially on tracks with great scenery. The orangey-red hues of a sunset make the perfect backdrop for Project CARS and quickly became our favourite time of day to race.

So, is it the best-looking racer ever? Probably not. While the cars look great, some areas of the track are still blocky and low-res, not something you'd expect from a 2015 racing simulator. With this being said, the graphics are far from being classed as being 'bad' and shouldn't detract from the overall experience of the simulator.

Lets get down to the most important aspect of the simulator – the handling. It's very difficult to comment on the handling of the cars as Project CARS has done a great job of making each car handle differently. It adds another level of realism to the simulator as you can feel the handling vary between the different cars and classes of cars, and it's both exciting and challenging. We found that we'd get comfortable with a car and then have to move on to a different one, which forced us get used to the handling all over again.

While learning to properly control a variety of cars is fun, restrictions



in races take the enjoyment away from us. We've had more than a handful of experiences where we've only slightly gone outside the lines and we've had penalties given to us, and with no rewind/replay option, we found ourselves restarting races over and over again. If we had one feature to add to Project CARS, rewind would definitely be it – if you're trying to qualify for a race and get penalised at the last corner for clipping the back of a slower car, its more than annoying.

Racing enthusiasts will be happy to hear that you're able to edit your Tuning Setup in Project CARS. We're not talking about spoilers and a new paint job, but instead tweaking elements such as tire pressure and brake balance, which can give you the edge when racing.

Racing

Driving in Career mode is fun, but we found it repetitive after a while. For the majority of races, you have two practices of 10 minutes (real-time) each, which is supposed to help you learn the course. After the practice, you have two qualifiers that last 10 minutes each and then you finally have the lap-based races that count towards the Championship. You can get the full racing experience and extend the 10-minute time limit.

Although we must admit that doing practise runs did help us nail some particularly difficult corners, it also became very boring. The same bends and corners again and again, lap after lap. You have the option of skipping the practises and qualifiers once you've done two laps, but it'll put you in last place for the race's start – a position that no driver wants to be in.

As well as offering many tracks and cars, there's another aspect of Project CARS that has many options: camera angles. There's the standard third-person view from outside the car and first-person view from inside driver's seat, but there are others on offer, too.

There's a GoPro-style angle from the roof of the car, as well as a POV shot from inside the riders helmet – the best part of the riders helmet view is that audio is distorted as 'you' are wearing a helmet. Slightly Mad Studios has also announced that the simulator is compatible with both Oculus Rift and Project Morpheus – something that will add an extra dimension to the game.

There is one element to the simulator that we particularly dislike, and that's the menu system (see above image). The idea of Project CARS is to let you go from one race to the next quickly and easily, and while this is technically true, the layout of the system takes a lot of getting used to.

When we first started playing, we weren't even too sure how to start races in Career mode. The races you must join in Career mode are displayed as a calendar – but all races for every class are displayed on the calendar, and even though applicable ones are highlighted, it still initially took us by surprise and were unsure where to go.

Verdict

Project CAR is a fun to race but unless you're a dedicated racing fan, you may soon find yourself getting bored. ☒ **Lewis Painter**

GAME

The Witcher 3: Wild Hunt

£34 inc VAT

Contact
■ thewitcher.com

Specifications
Available for PlayStation 4, Xbox One, PC



The Witcher 3 is one of the most anticipated game releases of 2015. Available on Xbox One, PlayStation 4 and PC, it has a huge open world to explore along with a great combat system and more enemies than you can shake a stick at.

It starts, as many games do, with a tutorial that introduces players to the mechanics of the game and the combat system. Despite being a bit slow to start, with conversations that you want to skip to get into the action, the tutorial gave us a taste of what was to come – and we liked it. It also introduced us to the main characters in Witcher 3: Geralt, Yennifer and Ciri, which is great for those of you (like us) who didn't play Witcher 1 and 2 because there are more characters in Witcher 3 than you'll be able to remember.

One fantastic aspect of The Witcher 3 is the cause-and-effect style system it uses. You're constantly interacting with people and the choices you make in these conversations can have adverse effects not only for the person you're speaking to, but whole communities at times.

It can also effect how people act towards you, both positively and negatively. For example, early on in the game you have the choice of whether or not to accept coin from a merchant that you'd just saved. We chose to reject the money from the (poor) merchant and he, in return, gave us information about the location we were looking for and even offered a huge discount on any items in his store. It pays to be nice sometimes guys!

We were surprised about the variety of side quests available. Wherever you go, you'll be greeted with secondary tasks that range from bare knuckle fighting to slaying a ghost that has been tainting the village well. Though most of these can be found via notice boards in towns and villages, some only pop up when you're near them, while others depend on your actions in conversation.

However it's not only the variety of side quests that surprised us, it's about the quality of the side quest. They could easily pass for main story quests – in fact, at times we thought we were undertaking a main story task when it was in fact a side quest. Though farming berries is a (rather tedious) part of a handful of side quests, they're much more than that.

Side quests usually produce unimpressive rewards, but every now and again you get some fantastic goodies. For example, we helped someone save her daughter by brewing a Witcher potion and in return she gave us a book about vampires. You can read the book to add the entry to your Bestiary, accessible via the main menu, to find out more information about your opponents in battle including its weaknesses.

Though that by itself may not sound impressive, on the next story quest we came across a vampire that we had to slay. How do we kill it? What are its weaknesses? Oh wait, we can just check the Bestiary and find out. The point is that even though it may not be amazing at the time, even the smallest rewards can come in handy and give you the upper hand at vital moments throughout the game.

Open world environment

The Witcher 3 is open world, and it's huge – we've yet to explore the map in its entirety after over 40 hours of gameplay. It's not all similar either, there's a huge variety of environments and each region has its own unique characteristics, be it the war-torn region of Vizima or the vast city of Velen.

The sheer scale of the open world combined with side quests mean that exploring in The Witcher 3 is extremely fun. It'll almost always produce a unique experience filled with everything from taking down a griffin to sword fighting with a group of outlaws. Combat aside, there are many locations to explore and scavenge, some that even require a boat to access.

Exploration is only improved by the dynamic time and weather. It's interesting how a slight change in weather or time can greatly change the look of a particular environment. One island, for example, is ominous at night, with ghouls and drowners roaming around a half-dead forest surrounding a dilapidated tower. However, once morning comes and you see the rays of sunshine through the trees, the scene changes and suddenly the on-edge feeling we had disappears.

Sunrises and sunsets are particularly gorgeous and the rain looks and sounds realistic. Though it may not have the level of detail as, say, DriveClub, it's more than enough and adds to the level of realism that you feel when playing a role-playing game such as this.

We reviewed The Witcher 3 on a gaming PC with an nVidia Geforce GTX 960 GPU and were able to run it at full 1080p in 'Ultra' level graphics. Also, by setting the framerate to 'unlimited', we got beautiful results averaging around the 80- to 90fps mark. These two factors produced gameplay that was stunning.

We expected the framerate to drop when in a crowded area, such as in the city of Velen, but for the most part this wasn't the case. There's just one single place (that we know of) that reduced the frame rate slightly, and that's at Crow's

Perch when walking through the village inside the castle walls. We're not too sure why this is the case, as we've been in other locations with many more NPC's with no issue, but it's one we came across time and time again in that one area.

However, while we suffered framerate lag, the drop was insignificant (80/90fps to around 50/60fps) compared to the console version of The Witcher 3. The Witcher 3 on Xbox One and PlayStation 4 offers 30fps gameplay, which is fine, but not when you walk into an area full of NPC's and have the framerate drop even lower. Though PCs can have more powerful graphics than both next-gen consoles (depending on spec), we'd expect more from the next gen consoles and the game itself.



Controls and combat

The combat system is, at the same time, one of the best and most frustrating we've used recently. Prior to its general release, we were teased by YouTube videos showcasing highlights of the combat system including blocking hits, dodging/jumping and using Signs to gain the upper hand in battle.

Our first experience of the combat system during the tutorial was a far shout from this, with uncoordinated attacks and blocks that almost ended up with a dead Geralt. However we powered through, as getting used to a games controls and perfecting them instantly is something that very rarely happens.

After narrowly missing death in a handful of battles, the controls just 'clicked' for us and we found ourselves able to block with precision, knocking enemies off balance before unleashing a flurry of fast and hard attacks. From that point onwards, the combat system was amazing – you can fight multiple enemies at once, once you've got the timing right.

There are a variety of fighting styles that you can adopt to keep the combat system fresh. You can play it safe and hold the block button to block incoming attacks, you can time it to parry the enemy and knock them off guard, or you can even use a Sign to burn them or knock them down before executing them. Many enemies have a specific weakness, which forces the player to switch up their gaming style in order to defeat them.

However, any minor issues we had with the combat system were eclipsed by the hugely frustrating controls when riding Geralt's horse, Roache. This is, the worst part of the game, but such an integral one at the same time. Exploring such a huge and varying environment would prove a task even for the most experienced Witcher, so Geralt has his horse Roache to take him wherever he needs to go.

You trot along a little bit faster than walking pace by default, then by holding Shift, you go into a faster trot before heading into an all out gallop, which consumes your horses stamina. The good news is that if you're on a path, Roache will automatically follow the path and his stamina won't decrease, making it much easier to get around (in theory). Unfortunately, this wasn't the case. Sure, Roache's stamina stayed full but he had serious issues with following the path, venturing off at almost every turn in the road.

Character progression is a huge part of The Witcher 3 and without upgrading your characters abilities and equipment, you'll quickly find yourself struggling to defeat even low-level enemies. You get points to upgrade Geralt's characteristics with every level up, which you can use to upgrade everything from the amount of health and stamina that Geralt restores to the power and speed of his fast attack.

You can also influence people using one of your Signs (Axii), but you'll quickly need to upgrade it before trying to influence high-level opponents. If you do upgrade the ability, you'll find it pretty useful in tense situations – particularly when there are groups of men that want to confront Geralt.

As well as upgrading Geralt's abilities, it's important to keep him protected with armour and strong weapons. He has two swords, one steel sword for human enemies and one silver sword for non-human enemies. You can craft new, better swords once you find the engram for it and bring the correct supplies to a blacksmith or you can simply buy one instead.

You can also craft potions, which you can do yourself instead of needing a third party. Potion effects can range from increasing your damage output or allowing you to see in the dark, and are primarily made up of berries, which you pick throughout the open world. The only frustrating part of the crafting process is that while you may know what ingredients/berries you need, you're given no idea as to where to find them. However, once you've created your potion, you never need to craft it again.

Verdict

The Witcher 3 is phenomenal value for money. We sunk over 40 hours into it and were nowhere near finishing. The graphics and dynamic weather effects are great additions and the sheer size of the open world means that you'll have many, many interesting and unscripted experiences while exploring. ☒ **Lewis Painter**

OPERATING SYSTEM

Windows 10

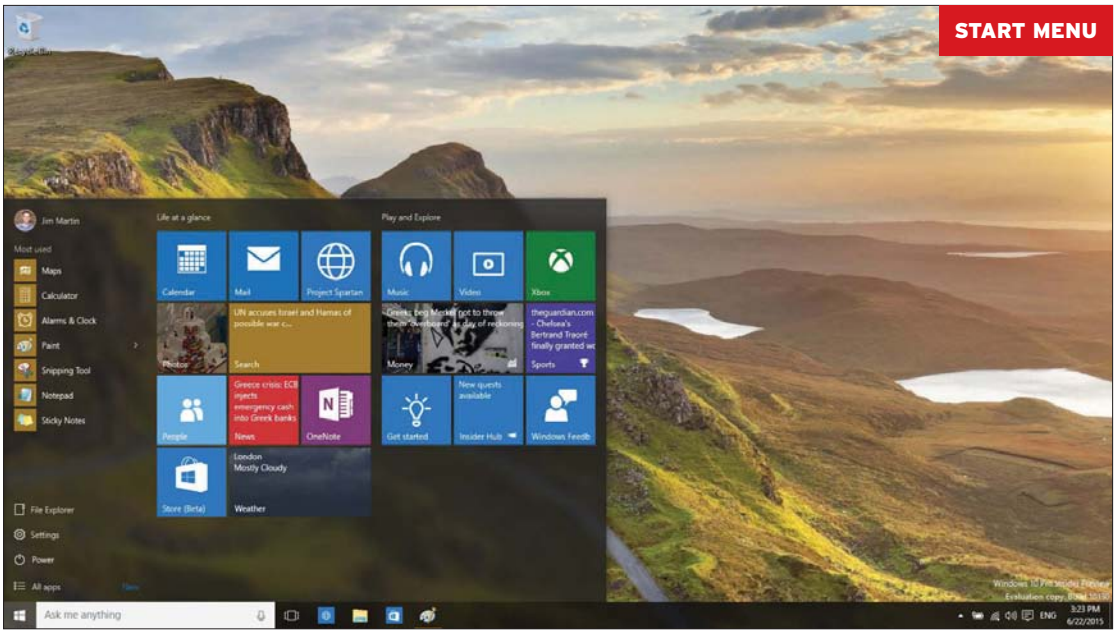
Free
Windows 7 and 8.1 users
£99 inc VAT (Home)
£189 inc VAT (Pro)

Contact
■ microsoft.com/en-gb

Specifications
1GHz or faster processor; 1GB for 32-bit or 2GB for 64-bit Windows 10; 16GB drive space for 32-bit or 20GB for 64-bit; DirectX 9 or later graphics card; 1024x600 pixels or higher display

Ease of use: ★★★★☆
Features: ★★★★☆
Performance: ★★★★☆
Value: ★★★★★

★★★★☆



In late 2014, Microsoft took the wraps off the Technical Preview of its next Windows operating system, and in doing so it took everyone by surprise. We expected the next generation of Windows: we just didn't expect it to be called Windows 10. None the less here is Windows 10: the next operating system for PCs and laptops, smartphones and tablets. And, indeed, an OS for servers and all points in between.

Microsoft said that Windows 10 is built from the ground up for a world in which mobile- and cloud computing are key. Execs from the company said it was committed to making Windows 10 friendly for the enterprise, ideal for keyboard and mouse users, but also optimised for touch. Oh, and the operating system will put the same interface on devices with displays ranging in size from 4- to 80in. "One product family, one platform, one store," says Microsoft.

Given the lukewarm reaction to Windows 8, these seem like bold claims. They are necessary, though. Also necessary was Microsoft's decision to make Windows 10 the most beta-tested product it has ever released. The operating system was tested by over 4 million people around the world before its launch.

What's new?

Critically the Start Menu is back. It contains standard Windows software and Windows apps. Modern UI apps, as they used to be called. Or Metro apps, if you want to go right back to the beginning.

But this time the Start menu is improved, and it may even make Windows apps useful. Look to the left and you'll see a list of your most-used apps, just as in Windows 7. At the bottom we see an 'All apps' shortcut, plus shortcuts to File Explorer, Settings and – conveniently – shut down and standby.

And Microsoft has retained the functionality of the Windows 8 Start screen over on the right, with resizable Live Tiles, so that you can immediately check unread mail or Calendar appointments. The Start Menu is customisable, too – you can resize it, and rearrange the tiles, create groups of tiles, and also revert to the Windows 8 Start Screen, should you wish to.

The full-screen start menu is really meant for tablet use, where it makes most sense, but you can choose to use it on a PC or laptop without a touchscreen if you like.

We're fans of the tile concept, if not the inelegance with which they're currently presented. As with Windows Phone, it's what you can pin that matters. Instead of merely adding shortcuts to apps, you can pin tiles which are shortcuts to specific functions or features within apps.

This makes life a lot more convenient when you begin pinning the right stuff. For example, you could pin a particular email or conversation thread from Mail or Facebook, or pin a certain journey (your commute, typically) in a travel app. It saves a lot of time, believe us.

Search and Cortana

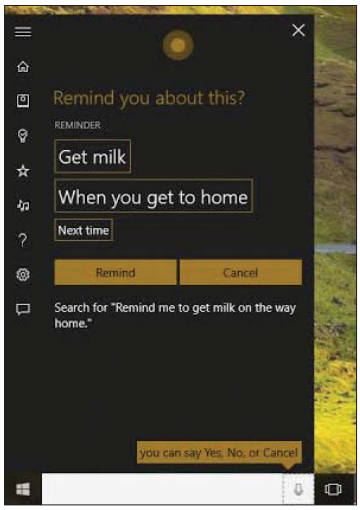
Instead of placing a search box in the Start menu, or hiding it completely as is the case in Windows 8, Windows 10 sticks it front and centre on the Taskbar. This is a smart move, as it's always there ready to serve up whatever you need to find or what to know.

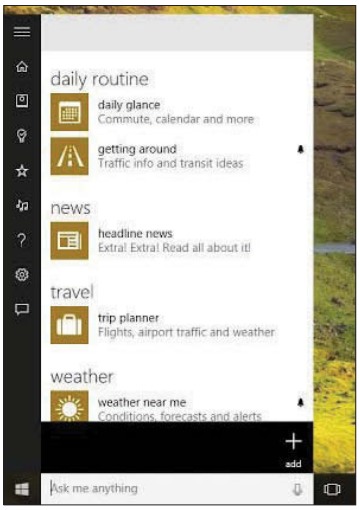
The first time you click on the box, you'll see a prompt to enable Cortana. That's because Cortana and search are pretty much one and the same in Windows 10. In fact, search is just part of the virtual assistant's remit.

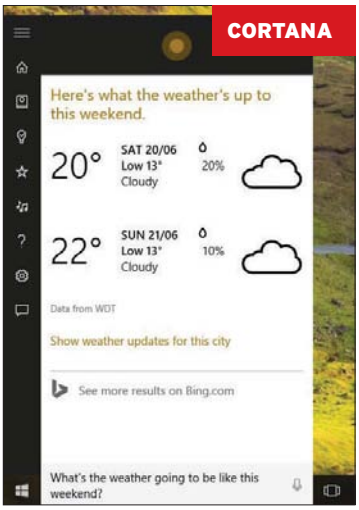
If you've ever used a phone running Windows Phone 8, you'll probably know Cortana already. The beauty is that you can type or talk to her and it's the same in Windows 10. It's much faster to tap the microphone button (or even say, "Hey Cortana") and reel off your request than to type it.

Sticking with search for a minute, you can type in a single word and Windows 10 will return a list of matching apps, settings and files, plus apps in the Windows store. It will also show a list of web results.

But there's lots more you can do, as all the features from Windows Phone are now in Windows 10.







So you can type or ask, "What's the weather going to be like this weekend?" and Cortana will display a forecast. You can also say "Remind me to fill in my tax return tomorrow night" and you'll get a reminder at the appropriate time. Reminders go even further, as Cortana can tie them to people and places. So you can also say "Remind me to ask James about that money he owes me" and Cortana will ask whether you want to be reminded at a specific time or place.

For places, you can say "Remind me to get milk and bread when I get to Tesco" or "Remind me to water the plants when I get home".

Cortana will show the top news stories, identify music playing and has a 'Daily Glance' which displays a summary of your meetings, today's weather, information about your daily commute, sports scores and more. If you allow it, Cortana can access information from emails, such as flight numbers and warn you if there's a delay or if there's heavy traffic on the way to the airport and you need to leave earlier than you might have. If Cortana can't answer a question directly, it will launch the new Edge web browser and display search results.

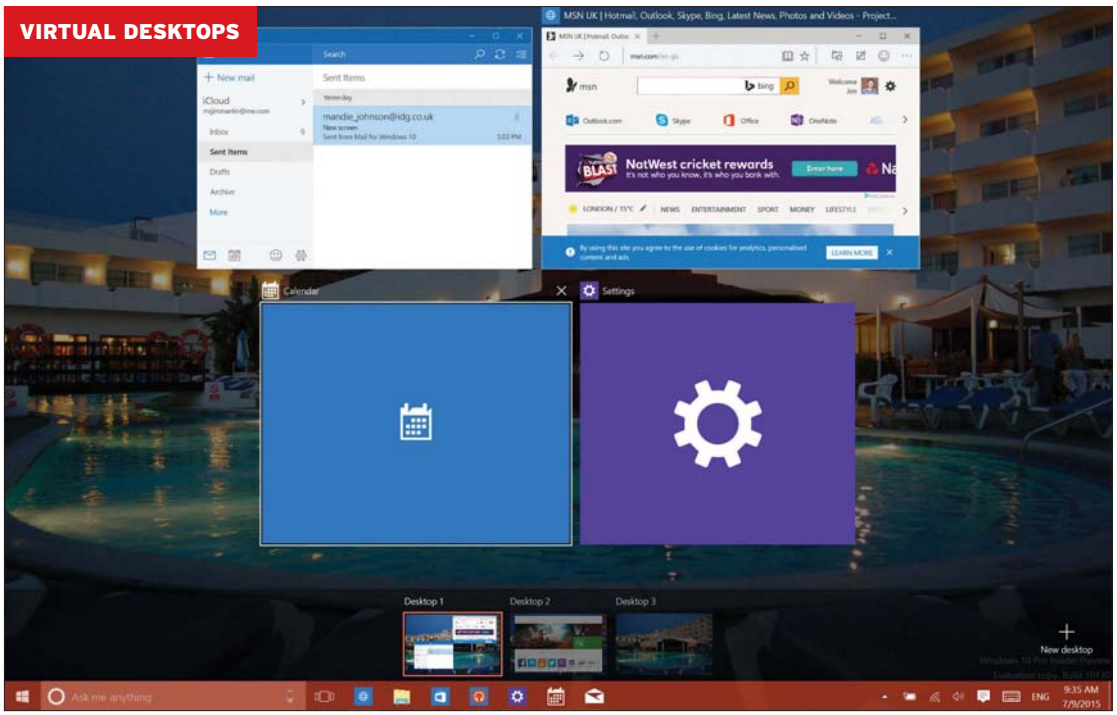
Finally, Cortana can set alarms, record notes, play specific music, launch apps and give you directions on a map. We think Cortana is great, and one of Windows 10's biggest draws. Learn how to use her capabilities, and you'll sure to be more productive.

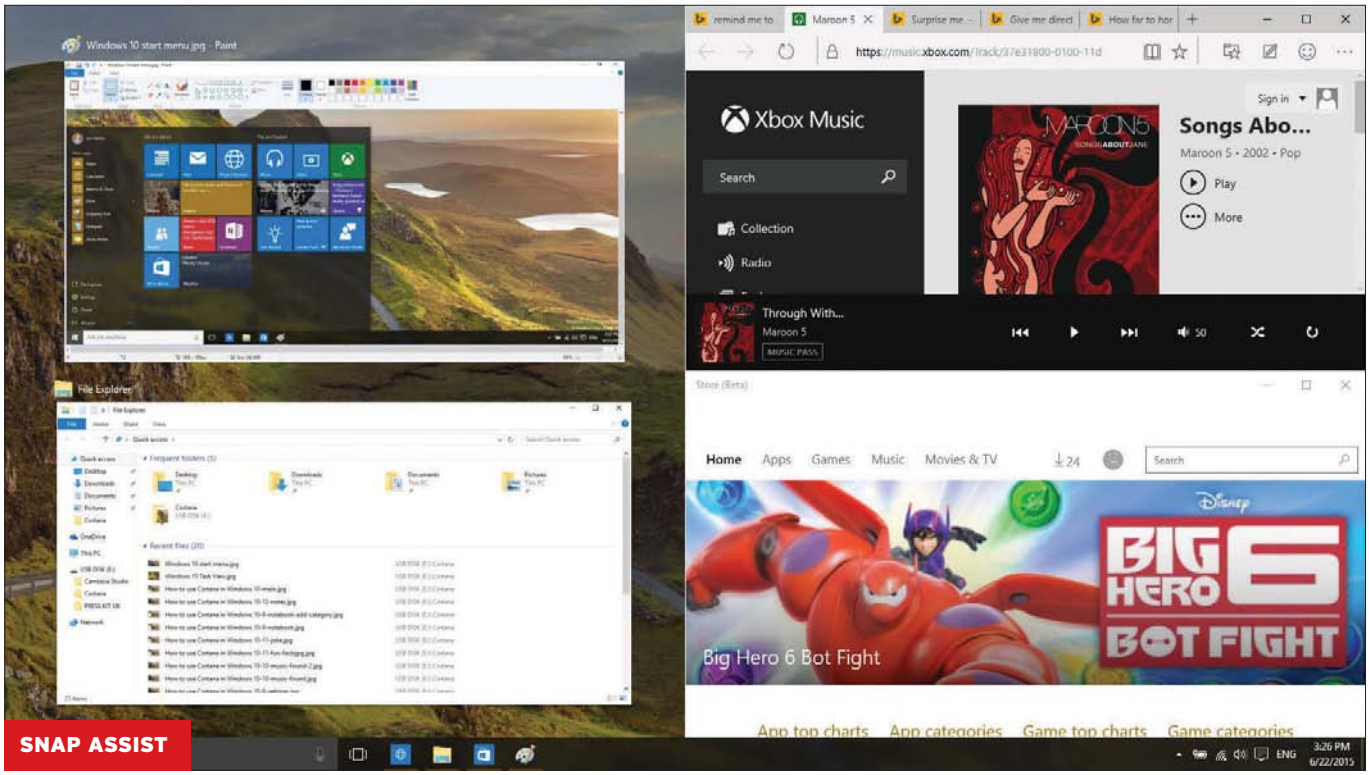
Returning to search and staying with the productivity theme, Windows 10 makes it easier to find your recently used files and frequently visited folders. This is because File Explorer replaces the Favourites section in the left-hand pane with Quick Access.

This makes finding files you've worked on faster and easier, without having to manually pin things to the Taskbar or add folders to the Favourites section manually. It also means you don't have to use the 'last modified' column to sort and find that file you just downloaded or edited yesterday.

Task View and virtual desktops

To the right of the search box you'll notice an unfamiliar icon. Click it and Task View will open. It's a lot like the view you get in Windows 7 or 8





SNAP ASSIST

when you press Alt+Tab. You can still use Alt+Tab in Windows 10 but the shortcut for Task View is Win+Tab.

Along the bottom of the screen, beneath the app thumbnails is a new bar showing virtual desktops. This is a feature that many Windows users have hankered after, but been forced to resort to third-party software such as Dexpot in previous versions of the operating system.

Now in Windows 10, you can create virtual desktops right out of the box. It's a simple case of clicking the Add desktop button and you've got a new, blank desktop on which to launch apps. Then you can quickly flip between desktops using Ctrl+Win+left cursor or Ctrl+Win+right cursor. This is much faster than using Alt+Tab and trying to find one Word document from 20 open windows. What's important to note is that unlike in Windows 8.1 you can use the new-style apps from within the Desktop area. This removes some of the pointless division in Windows on X86 systems. It also helps Microsoft make good on its claim that Windows 10 will feel familiar to Windows 7 users.

Snap Assist

Unlike in Windows 8 – where a snapped app takes up half the screen – with Windows 10 up to four apps can be snapped per screen, each occupying a quarter. When you've snapped an app, Snap Assist will display an Al+Tab view of some of the remaining open apps so you can quickly fill the entire screen.

You can still snap apps to fill the whole screen, or the left- or right-hand side, and the same shortcuts apply as with Windows 7 and 8.

Notifications

Although Windows 8 had pop-up notifications, things are much better in Windows 10. There's the equivalent of Windows Phone 8's Action Centre, complete with toggle buttons for common settings.

If you miss a pop-up notification – they appear in the bottom-right corner – you can swipe in from the right on a touchscreen to display the Notifications bar. Like most similar systems, it divides notifications by app and you can clear them individually or in one fell swoop, the latter being one feature that's frustratingly absent in iOS.

Buttons at the bottom of the bar include toggles for tablet and desktop mode, brightness, battery saver mode, Wi-Fi, Bluetooth, rotation lock, location, flight mode and more. You can expand or collapse the menu depending on how much room you want it to occupy.

Microsoft Edge

There's a new web browser in Windows 10, and it offers some unique features. As well as the reading mode you may already be familiar with from other browsers, which strips away page furniture so you can focus on the content, there's a new annotation feature that lets you highlight things and add notes and crop to a certain area of the page before sending them to others.

Having these capabilities natively in the browser is a compelling reason to use it over Google Chrome or Firefox. It has also been a decent performer in our testing.

Edge has been designed to have a minimal interface, leaving as much screen real estate as possible for web pages: the whole reason you're using a browser is to view them, of course.

Built-in apps

Some may mourn the loss of Windows Media Centre in Windows 10, but few people have PCs with built-in TV tuners and few laptops (and no tablets) come with optical drives for playing DVDs.

You do get media playback apps, of course. Instead of the Xbox branding which proved a little confusing in Windows 8, the apps are simply called Music and Movies & TV.

The Music app combines your local music with any stored online in your OneDrive Music folder. Plus, it also integrates Microsoft's music

streaming service called Groove – formerly Xbox Music – which you can access by buying a Music Pass. This costs £8.99 per month, or £89.90 for an annual subscription, making it a bit cheaper than Apple and Spotify's alternatives.

The Movies & TV app allows you to buy or rent videos from the new Microsoft Store but, like Apple, Microsoft currently lacks a streaming service to rival Netflix and Amazon Prime Instant Video. The app is split into three sections: Movies, TV and Videos, the latter of which monitors your Videos folder and shows them in the same easy-to-use interface.

Photos has been updated, but will be familiar to Windows 8 users. The old Windows Photo Viewer is still there if you prefer, and you're prompted to choose a default app the first time you open a JPEG. It's worth using the Photos app, however, as in addition to a decent viewing interface, it also lets you edit photos and pulls in photos from your OneDrive.

It should be no surprise that Skype is preinstalled, now it's owned by Microsoft. This means it's easy to call or video chat with friends, family and colleagues. While Office isn't included – it was only ever bundled with Windows RT – you do get the Mail and Calendar apps.

Mail is a clean-looking email client, which has the ability to handle multiple emails accounts including Outlook.com, Google, iCloud and Exchange (plus pretty much anything else, as long as you can configure the settings yourself).

OneNote is also part of Windows 10. If you haven't used it, you should certainly try it out. It's a powerful Evernote-style app which lets you create notes that are a mixture of text, lists, images, maps and more. Again, OneDrive integration means that you can access your stuff from other devices – even if it's an Android or iPhone.

Maps has been improved, too. Microsoft has added Streetside – the equivalent of Google's Street View – so you can take virtual tours of places, as well as getting directions and finding nearby places of interest. For directions, you can choose driving, walking or public transport.

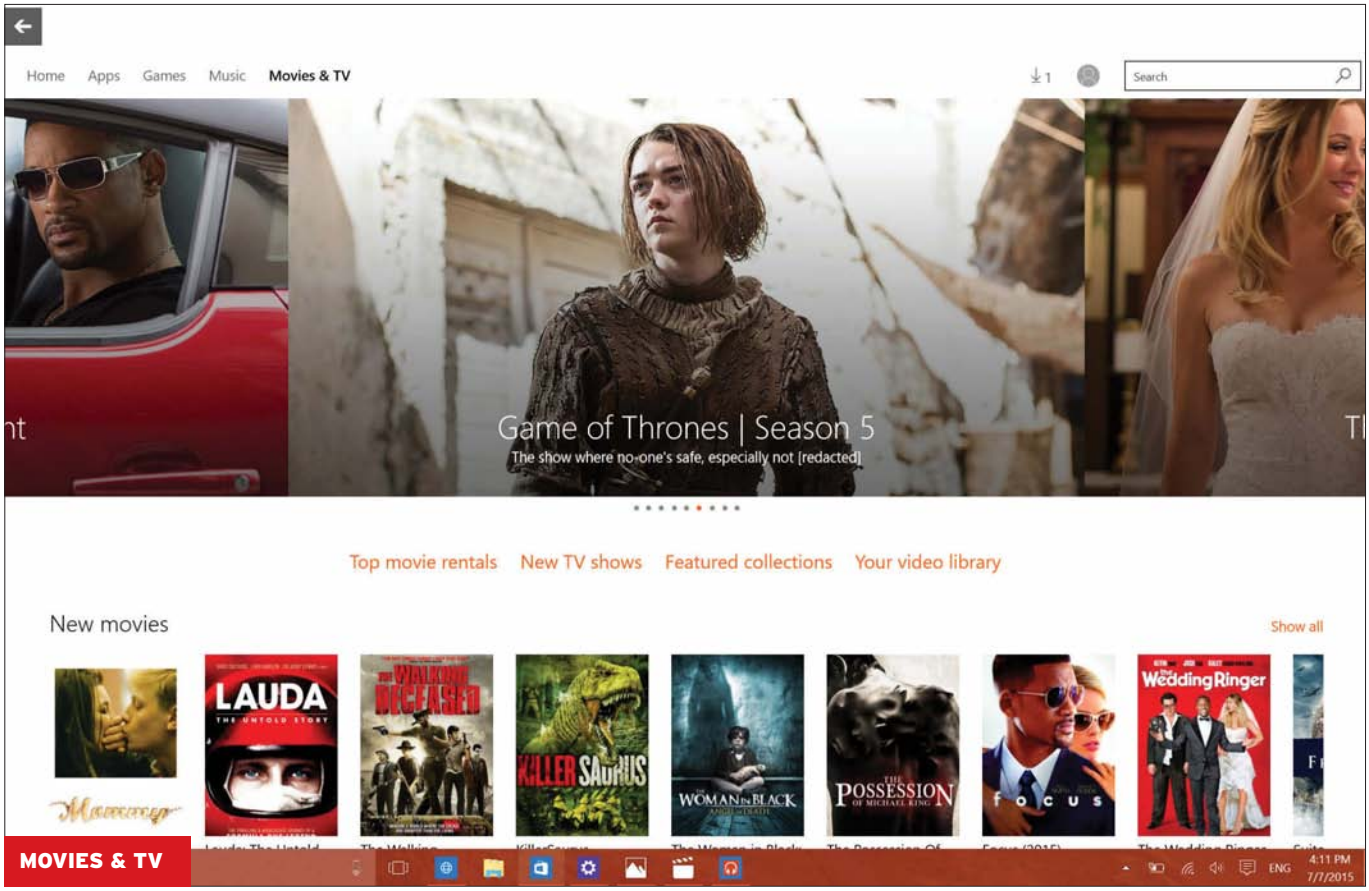
Verdict

For the majority of home users, Windows 10 is free and this means that there's really no reason not to upgrade. Unless there's a specific feature in Windows 7 or Windows 10 that you can't live without (see page 68) then the new features combined with the familiarity of Windows 7 make the new operating system very attractive.

It's even better if you have several devices that can run Windows 10 – particularly a phone – as the tight integration means you can set reminders on the go and pick them up on your PC, say, when you get home or into the office. That's just one tiny example, of course. If you use OneDrive to store your music, photos, videos, notes and documents, you'll be able to easily access them from anywhere.

Bear in mind that the 'final' version of Windows 10 Microsoft launches on 29 July isn't final at all. It's just the beginning: new features, including DirectX 12 support, will be added over the next weeks and months.

The bottom line is that Windows 10 is a great operating system. Indeed, it's fair to say even at this early stage that it's the best Windows yet. It's not perfect, of course, and there will undoubtedly be bugs that need fixing, so expect patches and updates soon after launch. ☒ **Jim Martin**



WINDOWS 10 FOR MOBILE



With the launch of Microsoft's upcoming operating system, we'll soon be waving goodbye to Windows Phone. But how do the two compare? In our preview, Chris Martin explains everything you need to know

Instead of moving to Windows Phone 10 – which would be the most logical choice as far as Microsoft's strange numbering choices go – the next version of the mobile operating system will be called Windows 10 Mobile. As far as we know, that is. Here, we'll look at every aspect of Windows 10 Mobile, including its new features, apps and user interface.

Before we dive in, it's important to note that no-one will be getting the update on 29 July when Windows 10 launches. Microsoft is still very much in the development phase and has only said that it needs "more time to deliver the optimal experience for mobile devices and you can expect Windows 10 Mobile to release broadly later this year".

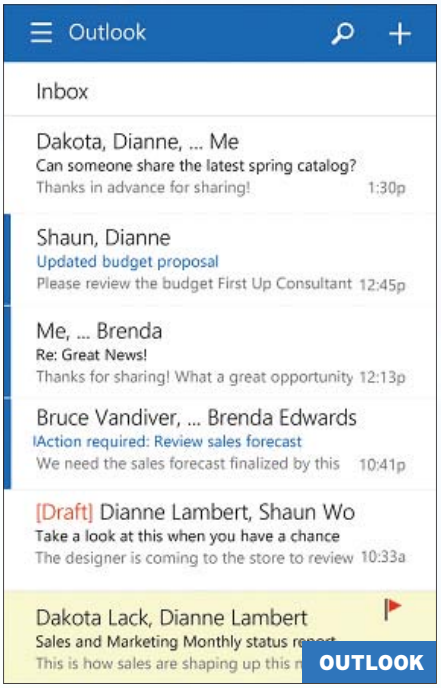
It's also crucial to point out that not a great deal is changing in terms of the interface. Windows 10 Mobile will look and work much the same as Windows Phone 8. There are lots of tweaks and improvements, but the biggest differences will be much tighter integration with Windows 10 on your PC. Part of that is Windows apps – previously called universal apps – which will be available in the new unified Windows Store and will work on all your devices running Windows 10. You can read more about universal Windows apps on page 76.

When you first use the OS, you'll find that it introduces a number of new options compared to Windows Phone 8.1. These include full-size art for the Start screen, an improved Action Center, interactive notifications, better dictation (and a generally better Cortana) and an enhanced Photos app. The operating system will be a free upgrade for many Lumia smartphones – see page 64 for details of those included in the preview versions. Smartphones running Windows 10 out of the box will arrive later this year, and will include the Lumia 640 and 640 XL.

We've been running the preview of Windows 10 Mobile since February, on a Lumia 830, alongside a laptop and Surface Pro 3 running Windows 10. Some things are bound to change in the interface, but here's how it stands at the moment.

What happened to Windows Phone?

Windows 10 is the first version of Windows built to run on computers, tablets and phones (as well as servers and other devices you probably don't care about). This means that developers will be able to build an app which will run on everything from a huge TV or projector screen, down to the 4in display on a phone. They can submit the app once to the Windows Store and Microsoft will do the crunching to make it work on any device running Windows 10. Developers will have to decide how the interface should look on a given screen size, but this change should mean that we'll see more apps than ever available on phones running Windows.



However, just because it's the same operating system as used by laptops and desktops, it doesn't mean you can run x86 programs (old Windows software) on your phone. You can't.

App updates

Outlook/Mail

Outlook is one of the first 'universal apps', meaning it will run across your PC, laptop, phone and tablet, with the same experience – although with a different interface for the smaller screen of a phone. It will synchronise everything seamlessly. As long as you're connected to the internet in one way or another all the information will be updated instantly. You could, for example, start replying to an email on your laptop, then finish it on your phone while you're on the go. In general this is the same for any universal app.

There's full Gmail support, as well as other webmail services including iCloud. In fact, there's much better support for all webmail services, so you don't have to be an Outlook user with an Outlook address to benefit from the stock email app.

Outlook Calendar

Calendar will be a universal app and it will be integrated into Outlook, too. As you'd expect, the app will synchronise across all your Windows 10 devices. This means it doesn't matter which one you enter an event on, it will show up everywhere.

One view in the Calendar app will give you an overview of the week, indicating how busy each day is, with details of specific entries below in chronological order.

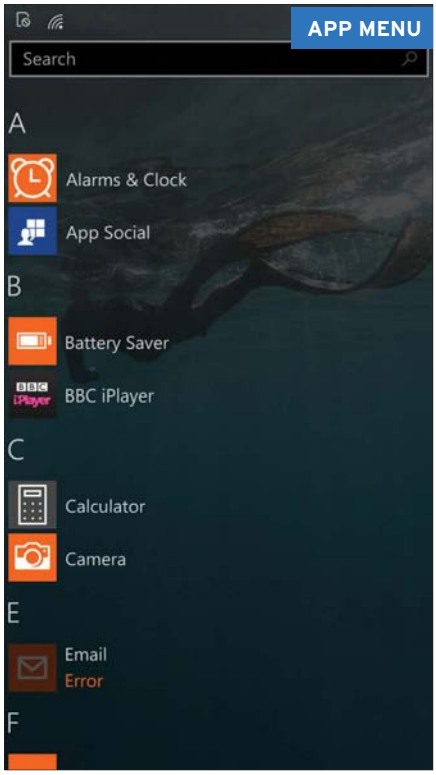
Office

There are new universal apps for Word, Excel and PowerPoint. They are optimised for touch-based input and will include the Office Ribbon, which means it should be familiar to just about anyone using Office 2007 or later on their PC or laptop. Your recent documents list will also be available across all your Windows 10 devices. As you'll see on page 76-77, your edits will appear almost instantly if you have the document open on more than one device.

Photos

The updated Photos app will also work across all your devices, and has been improved with better editing and management tools. This makes it easier to find the image you're looking for and give it a few tweaks before sharing it. The app automatically enhances photos and removes duplicates, too.





On the video side of things, you can easily scrub through a clip if you're trying to find a particular bit without having to simply guess how far in it is. Photos displays your shots in chronological order in the same tiled layout as that found in Windows Phone, 8 and you can choose whether or not to show photos and videos from your OneDrive. This means you won't need to head to it as a separate app to access that content.

One feature that's set to be introduced is Albums. This will enable you to group photos into themes, edit them and then share them with friends without using Facebook or photo sharing sites such as Flickr.

Maps

The current situation for mapping on Windows Phone 8 is somewhat confusing, with both Maps and HERE Maps (developed by Nokia) onboard. Going forward things will be different in Windows 10 with a Maps universal app.

The experience will be the same across all your Windows 10 devices. Bing Maps will be used for its search results, Streetside views will offer 3D imagery and there will be new navigation options.

Messaging and Skype

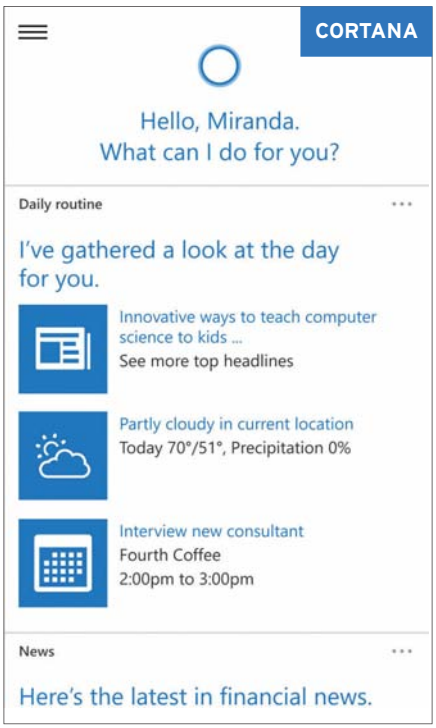
There's a big change when it comes to messaging because Microsoft has decided to combine phone calls, text messages and Skype (both messages and calls). There's a new dialler, but Messages is the focus for Windows 10 on phones.

In a similar way to iMessage and Google Hangout, the Messages app will display all the content in one conversation thread view – whether it's a regular SMS message or from Skype. Users can also quickly exit the thread and call the person easily.

Furthermore, the related People app (where you store all your contacts) will allow you to choose a preferred method of communications – whether that's email, text- or internet messaging.

Cortana

Microsoft's digital assistant – Cortana – is more powerful and has with more skills and language support in Windows 10 Mobile. As we hoped, dictation has been opened up to more uses, such as sending emails. The feature lets you use natural language so you can tell Cortana to send an email to



multiple people, a subject line and the body text. You can then use your voice to make corrections if there are any errors.

The blue circle that represents Cortana on the screen will also change, depending on what you ask and different situations – the aim being to give it 'personality'.

As with many features in Windows 10, the idea is to have consistency across devices. So if you set a reminder on your phone, it will pop up on your desktop at the right moment. That means you can use your phone while you're in the car to remind yourself of something when you get to the office or back home and you'll see it right on your desktop – minimising the chance that you'll miss the reminder.

The more you use Cortana, the better it gets to know you, and the more accurate its responses will be. At least, that's what Microsoft tells us.

Edge browser

Just as in the desktop version, Edge is Microsoft's new web browser for Windows 10 Mobile. It has an interface much like the desktop version, but doesn't have the same support for annotation, drawing and clipping – not yet at least. What it does have it a customisable reading mode that supports PDFs and a reading list, which will show up on all your Windows devices. There will also be support for background downloading in the final version, and you'll be able to check the status of files being downloaded in the Action Center.

User interface changes

Many of the changes in Windows 10 Mobile relate to the user interface. As we've mentioned already, it's not a massive departure compared to Windows Phone 8, so existing users will have no problems finding their way around, but will benefit from the tweaks and improvements listed below.

Recently installed apps

The usual apps menu sits to the right of the Start Screen and still shows all of your apps in alphabetical order. However, a new section will appear at the top called 'Recently Installed' showing newly installed apps.

New tile art

Since smartphones are personal, Microsoft has made various improvements to the Start Screen on handsets to make it more customisable. For example, you can select an image that will appear full-screen behind the tiles and the apps menu. Tiles that don't have



a solid colour are semi-transparent, so you can see the image behind.

One-handed mode

For phones with 5in screens and larger, you can now hold on the Windows button and the screen will slide down to bring things at the top into reach. Sound familiar? It's the same as 'Reachability' in iOS 8.

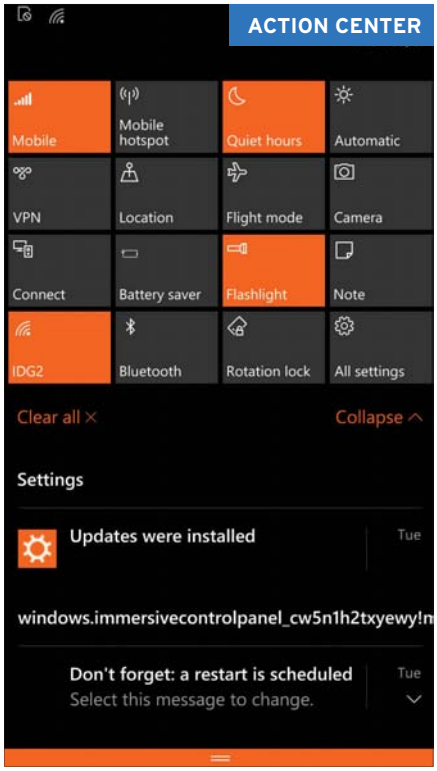
Improved Action Center and Interactive Notifications

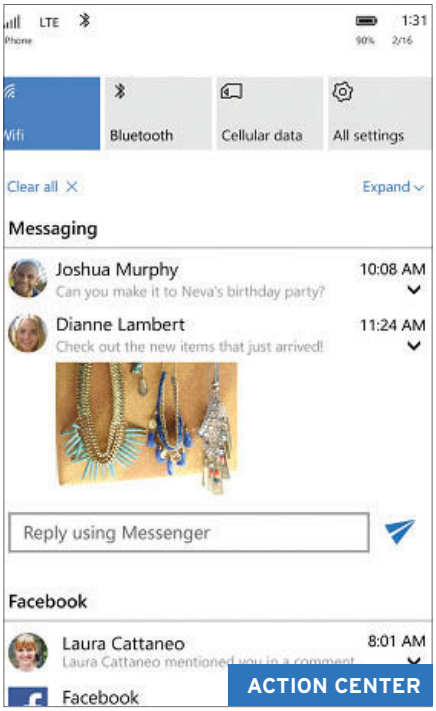
We were glad of the arrival of the Action Center on Windows Phone 8 and Microsoft has made some nice improvements in Windows 10 for phones.

More Quick Actions are available, so when you pull the bar down from the top of the screen you'll see the usual set of four. There's also a new expand button, which shows eight additional Actions when clicked, or when you drag down from the top a second time. Previously there was a simple link to all settings and you can still select which four you wish to be the primary ones. Brand new is a much-requested Quick Action for turning on the LED flash so you can use it as a torch without needing a separate app.

Action Center is also where you pick up all your notifications and while they are displayed in the same manner, they are now interactive. This means you can do various things straightaway. For example, you can dismiss an alarm, and when it comes to things such as text messages, you can reply inline via the keyboard or voice.

Another new features is that you won't need to dismiss notifications twice. If you get rid of one on your phone, then you shouldn't have to deal with it again if you switch to Windows 10 on another device. That's a real boon and something that we've been wanting on iOS and Android for some time.





New Settings menu

Long suffering Windows Phone users will be pleased to hear that the Settings menu has received a much needed overhaul. The existing one has been split into 'system' and 'applications', which is no bad thing as the massive list of options was extremely difficult to navigate with no apparent order or method.

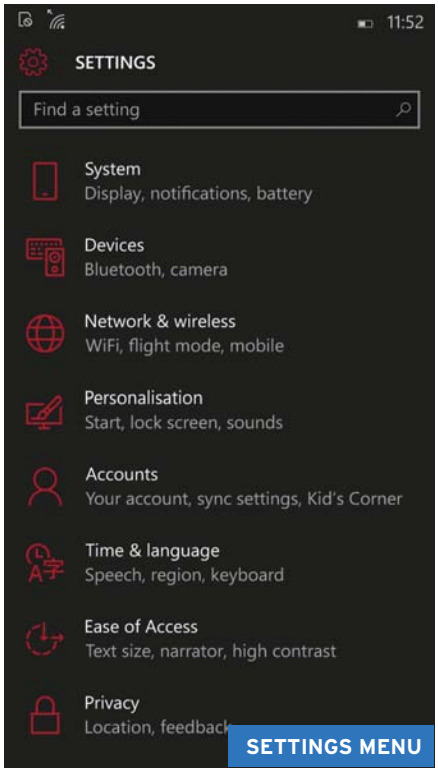
The new Settings menu is divided into 10 sections for things such as system, personalisation, accounts and privacy. It makes much more sense, and under each heading you can see what type of things you'll find there. A search bar at the top lets you type in the first few letters to quickly find what you're looking for.

New keyboard with joystick

The keyboard is largely the same in Windows 10 compared to Windows Phone 8, but there's a new feature that you might not even spot at first.

If you remember the way old IBM laptops had a tiny joystick in the middle of the keyboard for moving the cursor, well that's exactly what Microsoft had added to Windows 10 for phones in a virtual way.

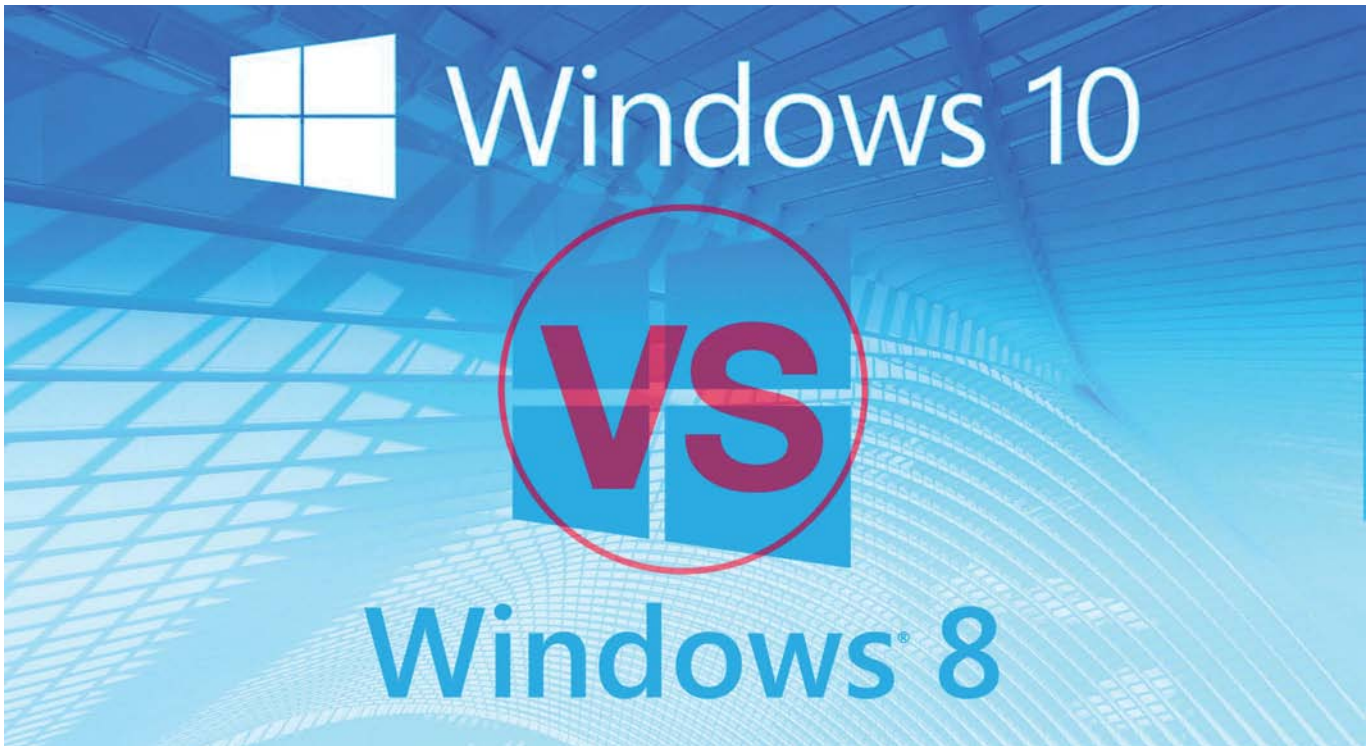
Rather than sitting in the middle of the keyboard, it's on the left-hand side between Shift, Z, the 123 button and semicolon. If you tap and hold it a little D-pad pops up and you can slide your finger around to move the cursor – it's pretty neat.



Verdict

There are some nice user interface tweaks in Windows 10 Mobile which make it much easier to use, but we're not talking about a massive departure from Windows Phone 8. Key to its success are universal apps, which will - supposedly - work seamlessly across all Windows 10 devices. That sounds great if you're going to jump in headfirst and commit to Microsoft's new operating system.





What's the difference between Windows 10 and Windows 8? Matt Egan explains

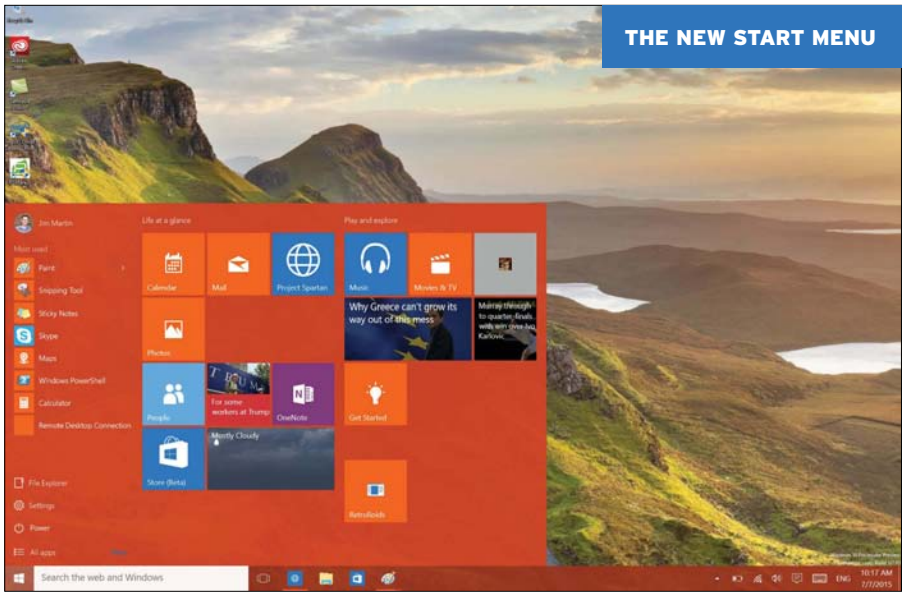
Windows 8 isn't everyone's cup of tea. We use it day in, day out at *PC Advisor*, generally avoiding the modern interface and sticking to the traditional desktop. We think it's a perfectly good and usable OS, but Windows 10 is markedly better. Here's why.

Price

If you buy a new PC or laptop before the end of July 2015, it will almost certainly come with Windows 8 (version 8.1 these days). As an end user, you will not know how much your PC's manufacturer paid for the OS, but if you purchase an upgrade or buy a licence outright, you will have to shell out. A standard Windows 8.1 upgrade licence will cost you around £100, while a Windows 8.1 Pro licence is priced £190.

When we went to press, Microsoft had said only that Windows 10 will cost the same as Windows 8 does now. Those prices are from Microsoft's online store, but you'll pay less if you shop around – Amazon is cheaper, for example.

Of course, most people won't have to pay thanks to the free upgrade for existing Windows 7, 8.1 and Windows Phone 8 users (many of them, anyhow). So if you are a Vista or XP user, you may want to think about upgrading now. Even if you jump only to Windows 7, Windows 10 will be free. Upgrading to a newer PC or laptop may be a better option, however, as machines running XP and Vista are already long in the tooth.


THE NEW START MENU

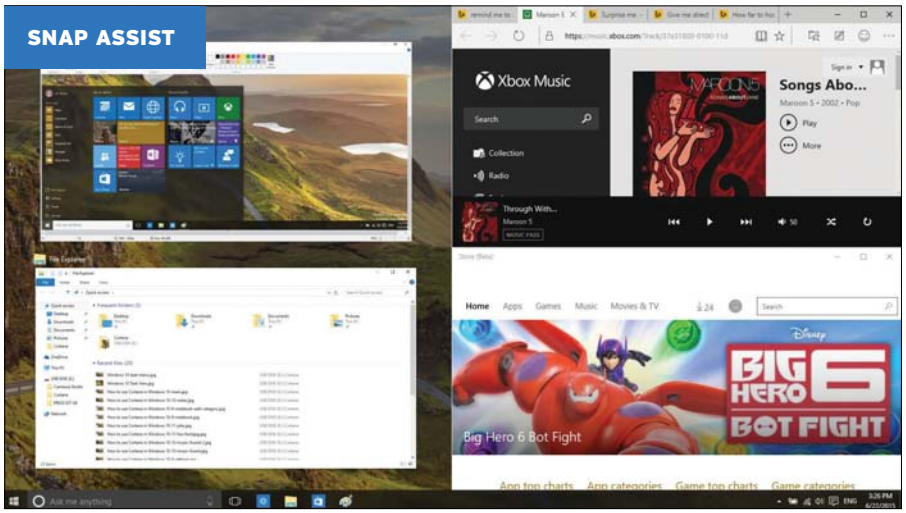
Devices

There are three different types of operating system that could reasonably be called 'Windows 8'. Four, if you count 64- and 32-bit versions. Windows 8 itself is x86 software built for use with PCs and laptops, as well as some tablets. Then there is Windows RT, which is for use on other tablets. Finally, there is Windows Phone 8 (which explains itself). Windows 10 will, at least in principle, do away with these divisions.

Microsoft claims that its new OS will run on all Windows PCs, laptops, tablets and phones. More importantly, all Windows 10 apps will work across all of those devices. It's a bold claim, and an exciting one. As of launch day, though, Windows 10 mobile won't be available except in a beta form, and very few 'universal' apps are available to test out.

Start Menu

The Start Menu is back in Windows 10, in more of a way than it is within Windows 8.1. This is a key change to the desktop. In Windows 10, it's been improved, in such a way that it may make Windows apps useful, even without the ability to use them across all Windows devices. The Start Menu includes a list of frequently used apps and shortcuts to PC settings. Here you will also



find documents and pictures folders. At the bottom there is an 'All apps' shortcut.

Microsoft has retained the functionality of the Windows 8 Start screen over on the right, with resizable Live Tiles, so that you can immediately check unread mail or Calendar appointments. The Start Menu is customisable – you can resize it and rearrange the tabs. You can also revert to the Windows 8 Start page, should you wish to.

Xbox

Finally, Microsoft is attempting to make use of the awesomeness that is Xbox, within the dreary world of Windows. Whereas Windows 8 users can install an Xbox app on to Windows PCs, it really doesn't offer much of the true Xbox experience. In its upcoming OS, Microsoft aims to change that.

With Xbox on Windows 10, the tech giant is attempting to add the best features from Xbox Live and the Xbox console. It comes with its own built-in Xbox app, offering a unified view of your games, the activity of your friends, and your own gaming activities. For the latter, there's Game DVR, which lets you record videos of your gaming sessions – and take screenshots – and watch them alongside clips from your Xbox One.

Windows 10 also bakes in Xbox Live, so that the more than 50 million players can connect across multiple devices in new ways.

Best of all, Xbox One games can be streamed to your Windows 10 devices – such as PCs, laptops and tablets – so you can play games even if your TV is being used for other purposes. This will be a literal game changer. And a massive improvement over Windows 8.

Cortana

Another key new feature of Windows 10 not available in Windows 8 is Cortana – Microsoft's semantic digital assistant. A kind of super Siri, which can engage you in conversation. More than simple speech recognition, Cortana constantly scours the web for information to inform its interactions with you. And it learns from your behaviour, contacts and so on, in order to better serve your needs. Cortana on Windows Phone is pretty great. And it improves with use. So the inclusion of Microsoft's digital assistant is a big boost over Windows 8.

Search improvements

Universal search in Windows 8 is a much-undervalued feature. It's been in Microsoft's OS since Vista, but came to maturity in Windows 8. Searching to load up apps and files is much more efficient than navigating via apps and file systems. The tech giant has made strides in this area in Windows 10.

The new OS has added a search button to the taskbar, which is also used for Cortana. This pulls one of the few important aspects of the Windows 8 Start page into the desktop. Search and File Explorer now display your recent files and frequently visited folders, which makes finding files you've worked on faster and easier.

Snap Assist and windowed apps

With Snap Assist every app in Windows 10 can be dynamically resized in a window. And unlike in Windows 8 – where a snapped app takes up half the screen – in Windows 10 up to four apps can be snapped per screen. This has the potential to be a killer productivity app – true multitasking on a single screen.

Even better, Snap a document to one side of the screen, and Snap Assist will suggest others that you may wish to open. Snap an app and Windows 10 suggests another, similar app that you might want to snap next to it. The feature is intended to save you the hassle of hunting about through menus or manually resizing apps to tessellate on your screen.

Task View, virtual desktops, Alt-Tab

Another useful and visual productivity enhancer is the way that Task View allows you to create a kind of multi-monitor setup within a single monitor. As with previous versions of Windows, you can use Alt-Tab to shuffle between windows. The difference here is 'virtual desktops', virtual displays into which you can snap multiple apps. So you could keep your email and web browser on one desktop that you hide away when you are working on an Excel spreadsheet.

For some people, this will be reason enough to upgrade to Windows 10, but others may have to force themselves to use them to understand why they're such a boon.

Verdict

We've covered the major feature differences here, but the additions mean that it's a no-brainer to upgrade if you have one or more systems running Windows 7 or 8.1. If you're in the position of having to pay for a licence, it's worth putting the money towards a new laptop or PC if yours is getting old. ☒



WILL MY PC GET WINDOWS 10?



Windows 10 is coming on 29 July and here's everything you need to know about reserving your copy, the minimum hardware requirements and how the upgrade will work. Jim Martin reports

Some Windows computers are already nagging users to upgrade to Windows 10, while others haven't made so much as a peep about it. Here we'll explain which versions of Microsoft's operating system are eligible for the free update and which aren't. Plus, we'll outline the system requirements, so you can tell whether your PC or laptop is powerful enough to run Windows 10.

How to reserve Windows 10

If your PC or laptop is running one of the qualifying versions of Windows, you'll be able to reserve your copy of Windows 10 ahead of its launch. What does this mean, we hear you ask? Put simply, the new OS will be downloaded in the days before 29 July, so that you're guaranteed to be able to update on that day. There won't be any overloaded servers, nor delays in downloading and upgrading. The download is 3- to 4GB.



To reserve Windows 10, click on the white Windows logo, which will appear near the clock in the Taskbar (below left) and then follow the instructions on screen.

If you don't see the icon, make sure that Windows is up to date by using Windows Update and installing all the available updates, including optional ones, but not the optional language packs. The update responsible for the icon (and GWX.exe program) is KB3035583. You'll also need to be running a genuine copy of Windows 7 or 8.1 Update as shown in the next section, right. Enterprise versions, or volume licence versions, don't count.

Which versions of Windows will get a free upgrade to Windows 10?

To find out which version of Windows you have, open Control Panel and go to System. The precise Windows version will be listed. It doesn't matter if it's 32- or 64-bit.

Only the following versions are eligible for the update:

- Windows 7 SP1 (Service Pack 1)
- Windows 8.1 Update
- Windows Phone 8.1

These versions are not eligible (some just require updating to the versions above):

- Windows 7 RTM (this can be updated to SP1 for free)
- Windows 7
- Windows 8 (this can be updated to 8.1 Update for free)
- Windows 8.1 RTM (this can be updated to 8.1 Update)
- Windows RT (the version of Windows used on the Microsoft Surface and Surface 2 – cannot be updated)
- Windows Phone 8.0 (updates may be available from your mobile operator or Microsoft)

In terms of specific versions, the upgrade will work on a 'like-to-like' basis:

UPGRADE FROM WINDOWS 7:

From Edition	To Edition
Windows 7 Starter	Windows 10 Home
Windows 7 Home Basic	
Windows 7 Home Premium	
Windows 7 Professional	Windows 10 Pro
Windows 7 Ultimate	

UPGRADE FROM WINDOWS 8:

From Edition	To Edition
Windows 8.1	Windows 10 Home
Windows 8.1 Pro	Windows 10 Pro
Windows 8.1 Pro Student	
Windows 8.1 Pro WMC	Windows 10 Pro
Windows Phone 8.1	Windows 10 Mobile

What about Windows 10 Insiders testing the preview builds?

Microsoft has announced that people running the preview version of Windows 10 will be upgraded to the final version for free. There are two options here. If you clean installed the Windows 10 preview, then you'll need to continue on the Insider program and receive future builds and updates to test and try out before the are released to the general public.

For the majority of users, the differences between Windows 10 Home and Pro will be negligible, as both provide pretty much everything you need for everyday computing

This means there is a kind of loophole by which you can have a copy of Windows 10 even if you don't own a version of the operating system that qualifies for the free upgrade. You will have to install a Windows 10 preview build before 29 July, though. Microsoft's blog clarifies that this is not intended to be a path by which you can freely upgrade your XP or Vista machine, though.

If you upgraded a genuine qualifying version of to the Windows 10 preview, you can get the final version on 29 July and then opt out of future preview builds and enjoy Windows 10. However, if you wiped your hard drive to install the preview, you'll have to opt in to the updates, or reinstall Windows 7 or 8.1 in order to get the upgrade to Windows 10.

What are the system requirements for Windows 10?

Just because your computer, tablet or phone runs one of the eligible versions of Windows this doesn't guarantee it will get the update. There are some hardware and software requirements as well.

These are the minimum hardware specifications needed to run Windows 10:

Processor: 1GHz or faster processor
RAM: 1GB for 32-bit or 2GB for 64-bit
Hard disk space: 16GB for 32-bit or 20GB for 64-bit
Graphics card: DirectX 9 or later
Display: 1024x600 pixels or higher (virtually all devices have this)

Will I lose my files and programs by upgrading to Windows 10?

Your files, settings and applications will be kept, but some settings and applications won't be 'migrated' as Microsoft puts it. For example, anti-virus software won't be moved. Windows 10 should keep your anti-virus settings and install the latest version of your AV software after the update, assuming your subscription is current. If it isn't, Windows Defender will be enabled instead.

Other apps which may not be moved include those installed by your computer manufacturer, as well as those which aren't compatible with Windows 10.

As before, you'll get a list of any such issues before beginning the actual update, so you can choose whether or not to proceed with it. Most applications that run in Windows 7 and 8 will work fine in Windows 10, so there shouldn't be many problems in this area.

Which features will I lose during the update?

You will lose some apps, games and features. For a full list see our Worst Windows 10 sacrifices article on page 68.

Will I get Cortana, Windows Hello and Continuum?

Cortana will be available on Windows 10 for the United States, United Kingdom, China, France, Italy, Germany and Spain. For speech recognition, you will need a microphone of course, but for 'better speech experience' you will need a 'high fidelity microphone array'.

Windows Hello is a new way to log into the operating system using facial recognition or a fingerprint. For that, you'll need either a special infrared camera or a fingerprint reader which supports Windows Biometric Framework.

Continuum is where Windows 10 will switch between laptop and tablet modes (see our feature on page 72). There will be a manual switch in all Windows 10 editions, but on some devices it will switch automatically, or be configurable to switch automatically.

Windows 10 Home vs Windows 10 Pro: what's the difference?

Alongside Education and Enterprise versions will be Home and Pro editions. All versions of Windows 10 include Cortana but will lack Windows Media Centre – and therefore the ability to use a TV tuner in your PC – and you will need to download third-party software if you want to watch DVDs on your machine.

For the majority of users, the differences between Windows 10 Home and Pro will be negligible, as both provide pretty much everything you need for everyday computing.

While Windows 10 Home is focused firmly on the consumer, the Pro version is more for power users, and those running small- to medium businesses. This can be seen in the advanced security features found in the Pro package.

BitLocker has been an integral part of the professional-level Windows operating systems since Vista. In Windows 10 Pro BitLocker allows users to encrypt individual files and keep them alongside unencrypted ones. Plus they can now be used in the same way on USB sticks, improving the way in which files can be shared between those with the proper clearance to read them.

As you would expect from a Pro version there is also support for Remote Desktops, Hyper V virtualization, Group Policy Management, and access to the Windows 10 Business Store. Microsoft also lists the ability to join Azure Active Directory, with a single sign-on to cloud hosted apps, plus support for Domain Join, Assigned Access 8.1, Enterprise Data Protection, and Windows Update for Business which Microsoft claims will reduce management costs.

Ultimately, Windows 10 Home edition will suffice for the vast majority of users who just want to browse the web, do a little work, and manage their media files. There's certainly plenty of benefits for the Pro version, with its focus on security and compatibility, but, of course, the value of these features will come down to whether you actually intend to use them or not. ☒

HOW TO INSTALL WINDOWS 10

You can install Windows 10 in two different ways. Jim Martin explains your options

For the first time, you won't need to buy a licence to upgrade to Windows 10 – so long as you have a genuine version of Windows 7 or 8.1 of course. That means you don't have a licence key, which in turn makes things a little complex when it comes to installing (or reinstalling) Windows 10.

Windows Update

A lot of people will have reserved Windows 10 and this means the upgrade will happen through Windows Update. Even if you haven't reserved your copy, you still have the choice to let Windows 7 or 8.1 upgrade itself using Windows Update to download and install the necessary files.

The process is similar to the regular Windows updates in that you won't have to do much except allow the upgrade to happen. Your files, applications and settings will be preserved, and everything should work fine when Windows 10 is installed, since even Windows 7 drivers are compatible with the new operating system.

When Windows 10 is installed, you will end up with a Windows.old folder on your C: drive containing your old operating system. You can remove this with the Windows Cleanup tool if it's taking up too much space.

ISO file

For many people, Windows 10 is an opportunity to start afresh and ditch years of junk that has accumulated on their PC or laptop. A 'clean' install is the type we always do here at *PC Advisor*, and it's what we recommend you do to.

With Windows 10 you'll be able to download the ISO file and keep it handy for future reinstalls. However, you can't wipe your hard drive (or use a new one) and install Windows 10 from the ISO file.

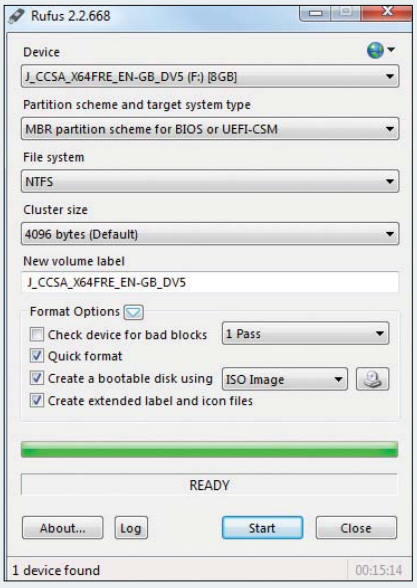
Instead, you'll need to run the EXE file once you've turned the ISO file into a bootable drive (or disc) and upgrade your existing operating system. When Windows 10 is installed it will activate online.

Then and only then can you begin the clean install by using the Reset function in Windows 10. You'll find it at Start > Settings > Update & Security > Recovery > Reset this PC (Get Started). Follow the onscreen instructions and you should see the option to remove everything and reinstall Windows.

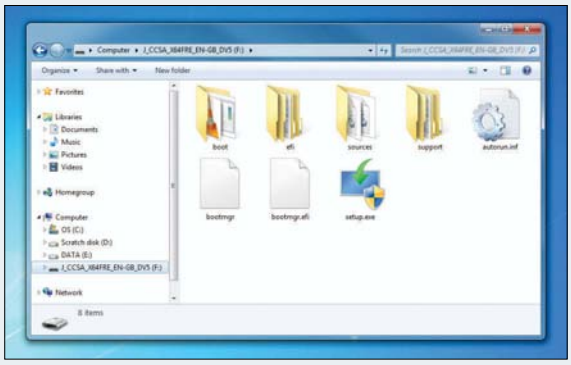
Before you upgrade

Since even an in-place update is a major operation, you must back up any and all files that you can't afford to lose. Clearly, you will lose everything if you do a clean install, so make sure you've successfully copied your files, email, music, photos, videos, deactivated any software that requires it (such as Adobe Creative Suite) and exported any settings and favourites from web browsers and the like.

HOW TO INSTALL WINDOWS 10 FROM ISO



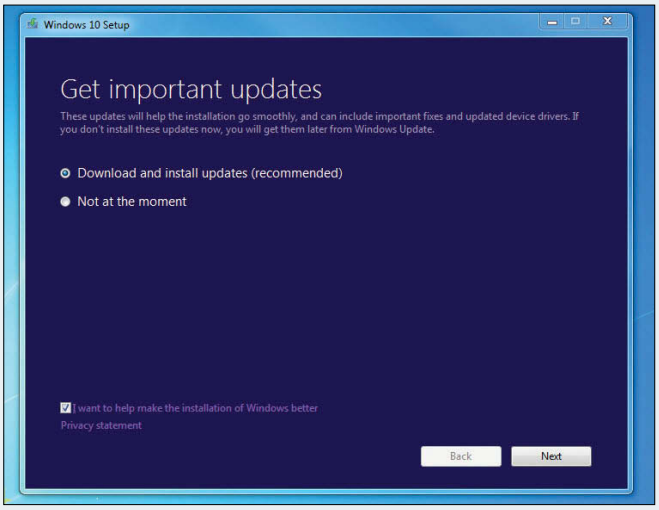
START Head to Microsoft's website (windows.microsoft.com) and look for a link to download Windows 10. There are 32- and 64-bit versions, so make sure you get the right one. Most people will need the 64-bit version. If you're unsure, go to Control Panel > System and Security > System and look at the System type field to see which version is currently installed on the computer you're upgrading. The 64-bit version is roughly 4GB, while the 32-bit is a bit smaller.



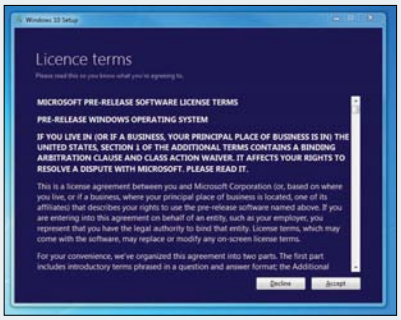
2 Download Rufus from rufus.akeo.ie, which is the tool you'll use to write the ISO file to a USB drive or writable DVD. You'll need at least a 4GB USB flash drive.

Run Rufus and check your flash drive or DVD drive is correctly selected at the top. Then choose ISO image next to 'Create a bootable disk using' and click the little button to the right and navigate to the Windows 10 ISO you downloaded. Click Start and the tool will get to work.

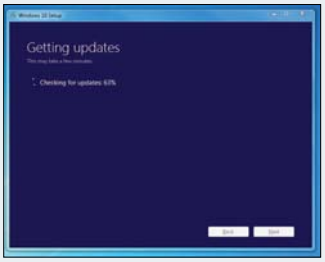
3 Now you have a bootable drive, navigate to it and run setup.exe. The first screen will ask if you want to get the latest updates – it's worth doing this.



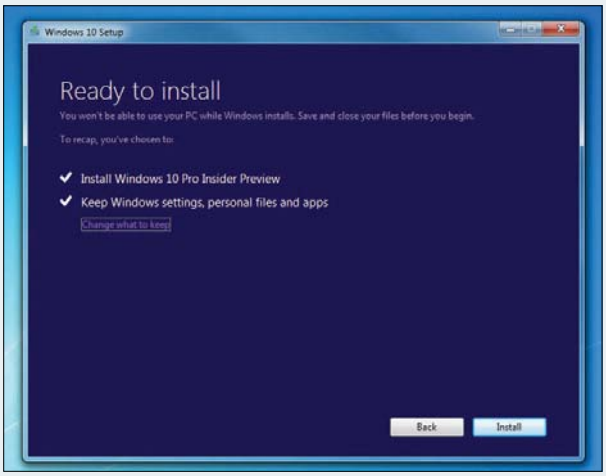
4 Accept the licence terms and if you chose to, the installer will download the latest updates. Then, it will check to make sure your system meets the minimum requirements, and if it does, will show a 'Ready to install' screen explaining that your settings, files and apps will be kept.



You may see a 'What needs your attention' screen explaining any reason why Windows 10 can't be installed and what you can do about it. For us, it was just a warning that the language would be changed.



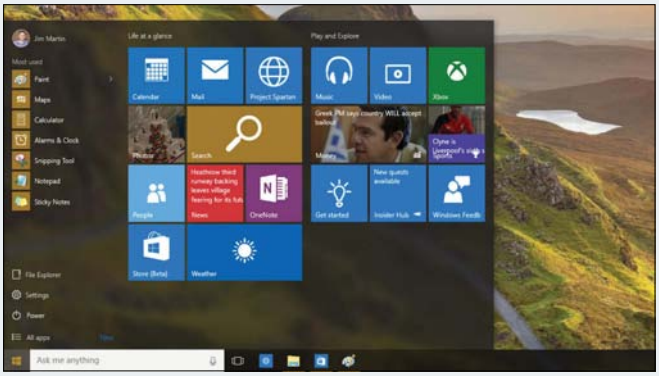
5 Click install and your PC will reboot. You'll see a Windows logo, followed by a language selection. Keep an eye on the install as it will reboot your computer and if you don't remove the DVD or flash drive, it might try to boot from it instead of your hard drive.





6 Windows 10 will boot, ask you a few questions and then ask you to sign in with your Microsoft ID.

7 When you finally get to the Windows 10 desktop, allow a bit of time for the operating system to search for drivers for your hardware. The screen resolution may be wrong, but after a few minutes the correct resolution should be appear. ☒





INSTALL WINDOWS 10 ON YOUR SMARTPHONE

If you have the right Lumia, you can get Windows 10 on your phone now. Chris Martin explains how

Windows 10 launches this month but you can already try it out on your smartphone. The operating system runs across all devices, including PCs, laptops, tablets and smartphones, and will take over from the Windows Phone OS. New features include full-size art for the Start screen, more settings in Action Center, interactive notifications, better speech-to-text and an improved Photos app. There's also universal apps versions of Word, Excel and PowerPoint, Mail and Calendar.

Supported devices

The Lumia 520, 525, 526, 530, 530 Dual Sim, 535, 620, 625, 630, 630 Dual Sim, 635, 636, 638, 720, 730, 730 Dual SIM, 735, 810, 820, 822, 830, 920, 925, 928, 1020, 1320, 1520 and ICON, and the Microsoft Lumia 430, 435, 435 Dual SIM, 435 Dual SIM DTV, 532, 532 Dual SIM, 535 Dual SIM and 640 Dual SIM.

Microsoft stresses that bugs may cause some devices to be removed from the list and fixes may add others.



START Head to the Store on your Windows Phone device and download the Windows Insider app.



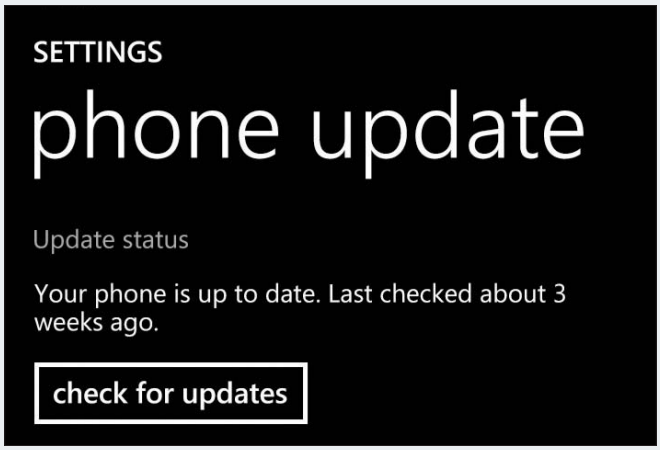
2 Once it's installed, launch the app and select the 'Get preview builds' option.

3 You'll need to enrol on the Windows Insider programme to get preview builds of the software and you have two options, Insider Slow or Insider Fast. Fast will get you updates quicker but they have the potential to be more buggy and crash. The Slow option will involve you waiting longer but receiving a more stable build. Select the one you prefer and hit the arrow button at the bottom of the screen.



4 Before you can install Windows 10 on your phone you have to accept the terms and conditions of the Insider Programme. Most importantly, it could void your warranty and have bugs that make your device unusable in some ways. We don't advise installing it on your main phone. If the device is your main phone and you really want to install Windows 10, opt for the Slow Insider option to ensure a more stable build.





5 Once you've accepted the terms, go to the 'phone update' section of the system settings and hit Check for updates.

6 Once the update has downloaded and installed, your phone will reboot and migrate some data. You'll then be given a 'success' message but you're not quite done. As it says, you can leave the phone plugged into the mains and let it do the rest or head to the Insider app to complete the upgrade. ☒



HOW TO UPGRADE FROM WINDOWS XP TO WINDOWS 10



Windows XP is still running on many PCs around the world. If you're one of the people realising that it's probably time to upgrade, Jim Martin shows how you can get Windows 10 on your PC or laptop

Let's get the bad news out of the way first. Windows XP and Vista aren't eligible for the free update to Windows 10. That means you will have to buy a licence.

The second piece of bad news is that you'll have to do a clean installation of Windows 10, as there's no way to upgrade and keep your files, settings and applications. It isn't a limitation of Windows 10 but of XP and Vista: even if you wanted to upgrade to Windows 7 from XP you'd have to wipe your hard disk and start again.

Price

For versions older than Windows 7, or non-genuine versions, you'll have to buy Windows 10 Home or Professional, which will set you back £100 and £190, respectively.

Should you buy a new PC or laptop?

As we often say, you'd be surprised at how much your PC appears to speed up when you install Windows afresh. Starting from a clean hard disk means there's no build-up of programs that start with Windows, slowing it down and using up precious memory.

Another great upgrade is an SSD. Solid-state drives are much, much faster than traditional hard disks and can give a new lease of life to a system you thought was destined for the scrap heap. (See our round-up of the best SSDs on page 82.)

If you have a machine that's over seven years old, it may be a better idea to save the money on a Windows 10 licence (and an SSD) and put the cash towards a new laptop or PC.

Update XP to Windows 10

If you decide it is worth splashing out on Windows 10 Home or Pro, you'll have the option of a physical disc or a digital download. It's unclear whether you will be able to run the downloaded version from within XP, but even if this is an option, it will erase everything on your PC's hard drive before installing Windows 10.

So, before you begin the upgrade, you will need to copy everything you want to keep to an external hard drive, USB thumb drive or a cloud storage service such as Dropbox, Google Drive or OneDrive.

Also, you'll need to find your software installation discs and licence keys. If you have misplaced the keys, use a free program such as Magical Jellybean Keyfinder to search the Windows Registry for these codes, and then write them down.

If you keep your email inbox or any archives, be sure to back these up as well, and export internet bookmarks and other settings that you want to keep.

Then, and only then, can you begin the actual installation of Windows 10. There's no guarantee that all your programs will be compatible with the new version of Windows, nor your old peripherals – specifically printers and scanners – so it's worth checking online to see if there's any information about their compatibility with Windows 10. If a Windows 7 driver exists for your particular model, it should work in Windows 10.

Upgrade to Windows 10 from XP or Vista for free

Microsoft has said that everyone testing Windows 10 on the Insider program will get to keep on using Windows 10 after the 29 July launch date since the program isn't stopping. This means you can sign up to be an Insider before 29 July, install the preview and get upgraded to the final version (and subsequent preview versions) without paying a penny.

This will be good news for some, but bear in mind that you'll be using what is in essence beta software again when the next preview build is installed after the launch version of Windows 10. ☒

Microsoft has said that everyone testing Windows 10 on the Insider program will get to keep on using Windows 10 after the 29 July launch date since the program isn't stopping.

HOW TO DOWNGRADE FROM WINDOWS 10

If you've upgraded to Windows 10 and want to return to Windows 7 or 8, there's a built-in tool that makes the process effortless. Martin Casserly explains how to return to your old version of Windows

The preview of Windows 10 has been an excellent way to try out Microsoft's new version of Windows. It's free, has some great new features and is easy to install. If you've already taken the plunge, but feel that you would prefer to return to a previous version of the operating system, then there is a fast and easy way built into the OS that can restore your old system. In this feature we'll show you how.

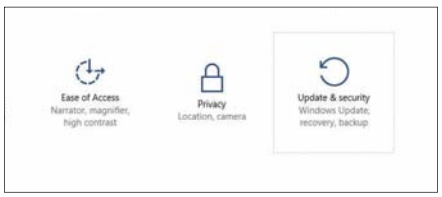
Before you begin

The first step is, of course, to back up any information you currently have on your PC that you want to keep. Changing an operating system is a big thing, and data can often be lost along the way. You can use external hard drives, thumb drives, or some of the various online cloud storage such as OneDrive, Google Drive, Dropbox or Tresorit, that offer lots of space for free. When you've safely removed any documents, video, photo, or other important data you need, you're safe to begin. Remember that this may also take a little time, so don't start if you have plans for the immediate future.

Using the Update and Security settings

When you install the Windows 10 technical preview on a PC that already has a Windows, the old version is stored away in a folder called 'Windows.old'. While this takes up space, it also means that you can restore the version via Windows 10 itself. To do this first open the Windows Start menu by clicking on the icon in the bottom left of the screen. Select Settings from the menu.

Now you'll see on option for Update & Security. Click this.

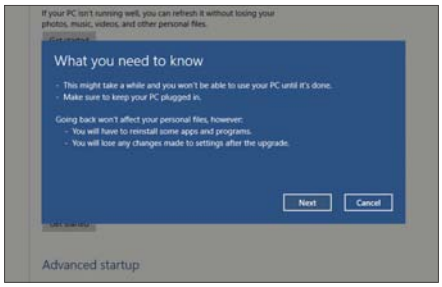


On the next page you'll find a list of options on the left, one of which is Recovery. Click this and the main pane will display a variety of choices. The one you want is 'Go back to a previous version of Windows'. Click 'Get started' to begin. If you're using a laptop you'll also need to connect it to a power source or the option won't work.



You'll now be presented with a blue screen (no death involved) asking you why you're downgrading? Take a moment to fill this in, as it's a helpful tool for Microsoft in gauging the user's experience with Windows 10. Click Next when you're done.

Before Windows starts the process, it gives you a couple more opportunities to cancel, and also reminds you that if you had a password on your previous version of Windows then you'll require it once the process is finished. If you're happy to proceed, click Next, then put the kettle on.

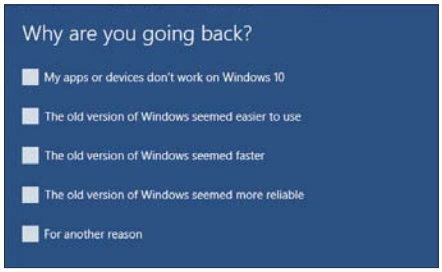


Windows will now roll back your system to how it was before the preview was installed.

Tidying up

On our test machine, which had very little installed on it, the whole process took about 10 minutes and was pretty much trouble free. The only thing we needed to change was the shortcut to Windows Explorer in the taskbar, which had stopped working. To fix this, we simply right-clicked on the icon, unpinned it from the taskbar, then searched for Windows Explorer in the Start menu, dragged it to the taskbar, and everything was working again. All of our data was intact and in the right place, and the only other reboot needed was for Windows to install a few updates. Fine work Microsoft. ☒









MISSING FEATURES IN WINDOWS 10

Windows 10 will introduce a raft of exciting new features, but some will also be lost. Matt Egan reports

We are excited about Windows 10: a free upgrade for virtually all Windows users, and one that will bring with it a raft of new features and functionality. But there are some down sides to the upgrade, and it is likely to be a tough one to avoid. Here, we outline the five worst Windows 10 sacrifices. You will miss them when they are gone.

Automatic updates

Not a missing feature, but a change few will welcome. Although the Pro and Enterprise editions of Widows 10 will both give the end user or network admin the opportunity to decide when updates are installed, Windows 10 Home users have no control. Windows Updates will be downloaded and installed automatically as soon as they're available. This probably makes sense for the entire herd to be immune from security flaws, but end users will not like being forced to install updates at Microsoft's will.

We will reserve judgment until we see how it works, but for now we will say that the idea of automatic Windows Updates sounds like a recipe for horror and disaster.

Goodbye Windows Media Center

Less painful than automatic updates to the operating system, upgrading will mean saying goodbye to Windows Media Center. The largely unloved entertainment centre of your PC will be despatched, to be replaced by a series of native media-playing capabilities and apps that don't require a separate 'Center'. In almost all ways this is unlikely to be too much of a pain, but we have heard from people testing the beta build that in the current iteration of Windows 10 there is no support for TV tuners, for instance.

This sounds plausible. As we outline below DVD playback capability is not native to Windows 10, and it is likely that only a few people use a TV tuner in a world in which most television content is available online. But that doesn't mean *no-one* will miss those features.

No more Hearts

Look. There is no other way of telling you this. It's not you, it's Microsoft. The tech giant has removed the card game Hearts from Windows. That's right: install Windows 10 and you will no longer be able to play Hearts. We're Heartsbroken.

Desktop Gadgets begone

Remember Windows 7's Desktop Gadgets? No. The chances are you probably don't. But if you are the one person who uses Desktop Gadgets, you need to prepare yourself for a loss. In Windows 10, there are no Desktop Gadgets. None.

Discs are destroyed

This may not be the biggest issue, but if you are currently using floppy disks on Windows, you will have to install new drivers when you upgrade to Windows 10. I rather expect that this will affect only a few people.

Perhaps more users will be distressed to know that according to Microsoft anyone who wishes to watch a DVD on their Windows 10 PC or laptop will have to install separate playback software. Microsoft has hinted that it will address this issue at some point, but from the get-go if you want to watch a disc, you will need to install VLC player or something similar. A pain, but probably a minor pain. ☒



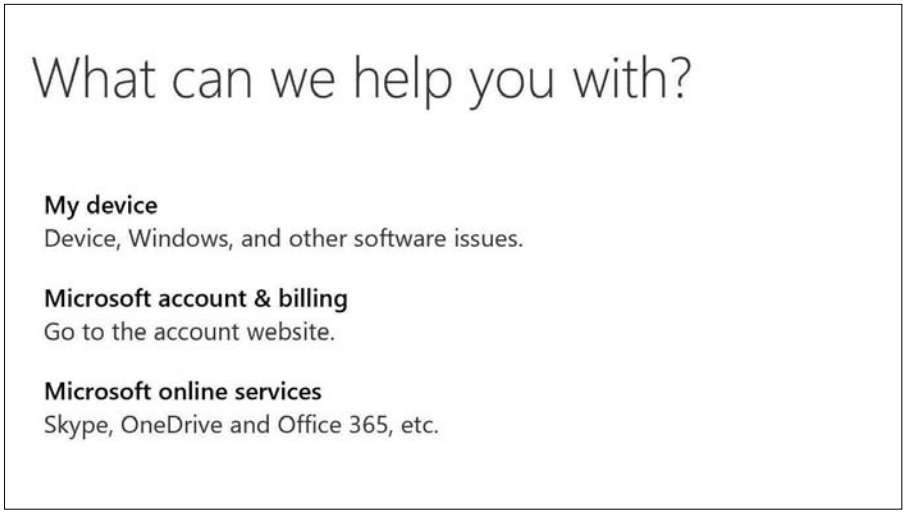


HOW TO GET FREE WINDOWS 10 HELP

Having problems with Windows 10? Matt Egan shows how to get help after you've installed the OS

Windows 10 won't be perfect, and it will be different to what you are used to. For a lot of people that difference will cause problems – Microsoft is not famed for guiding people through change in quite the way that Apple or even Google is.

So here we outline three great ways to get help with Windows 10. If you have a problem, the answer is here.



Microsoft

We wouldn't recommend you go down this route for just any minor complaint, but when you just can't find the help you need Microsoft has provided a safety net. In recent builds of Windows 10, the tech giant has added an app called 'Contact Support. Just as you might imagine, this gives you an easy way to contact Microsoft's Windows Support when needed.

The simplest way to access the app is to type **Contact Support** into the search box. Microsoft promises that once the app launches, in just a few quick clicks you will be connected by chat or phone to Microsoft Answer Desk. This is a one-on-one connection with what Microsoft calls a 'Windows 10 expert'.

From this app you can also connect with Microsoft's own Windows community forums, or chat online with an Answer Tech. And if things are very bad, you can request a call back so you don't have to wait on hold or schedule a call at a convenient time. Again, we wouldn't suggest you always go to the Contact Support app. But when times are really bad, it is a great final call.

Top Windows 10 tips and tutorials

We would, of course, recommend our own extensive Windows 10 tips and tutorials. Of course we would.

Our editors have spent months using the Windows 10 preview builds, putting together simple guides and tips and tricks to help you to get to grips with Microsoft's new operating system. We've focused on petty irritants and new features, trying to respond to what we think will be the biggest gripes of new users who suddenly find Windows 10 thrust upon them. You can find our tutorials at tinyurl.com/ono76dx.

Independent Windows forum

Last, but very far from least, is the *PC Advisor* Windows Help forum (tinyurl.com/psjbLn2). Our forums are Europe's largest technology help resource, peopled by more than 300,000 forum angels, happy to help users with problems large and small. The Windows Help forum is the place to discuss new features and compatibility issues with all Windows operating systems. Fix problems with Windows 10, but also XP, Vista, 7 and 8.

Search the forum for the answer to your question, or post your own question dealing with an issue with Windows 10 – whether on Windows PC, laptop, tablet or phone. Our experts will be delighted to help with any Windows problems you are having. ☒

> Microsoft promises that once the Contact Support app launches, in just a few quick clicks you will be connected by chat or phone to Microsoft Answer Desk

HOW TO USE CUSTOMISE THE WINDOWS 10 START MENU

The Start menu is back in Windows 10, and this time it is much more customisable than in Windows 7. You can change its colour, organise shortcuts and even group apps together. Mohamed Wahid shows how

Many people hated the Start screen in Windows 8. For most, it was too jarring a change from the traditional desktop. Microsoft has addressed this by bringing the old start menu back from Windows 7, but this time with a fresh design and more options that allow you to customise the menu to your liking. This start menu has a similar design to Windows 7 but integrates the tiles from Windows 8. Here we'll show you how to customise the Windows 10 Start menu by adding and removing tiles, resizing them, creating groups and changing the colour.

Move tiles

To open the start menu, press the Windows key or the Windows logo on a tablet or hybrid device. You can, of course, just tap or click on the Windows logo at the bottom-left corner of the screen, too (see below left).

To move a tile (in the right-hand area) click and hold the tile you want to move and the start menu should dim down. You can now drag the tile to the new position. Here we've moved the Mail tile (see below right).

Add a tile

Either use the search box to find the app you want to add, or click on the all apps link at the bottom left of the screen. Right-click on the app in the list and some options will pop up, select the 'Pin to Start' option. The tile will then be added to the menu on the right.

Remove a tile

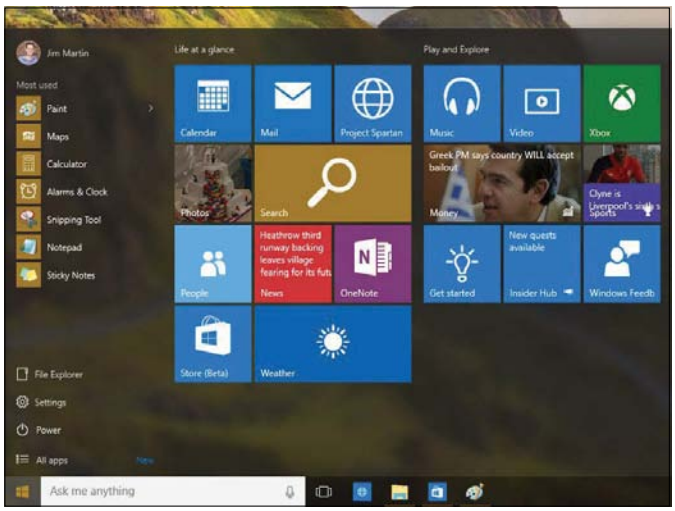
Some of the default tiles may not be those you'll ever use. Right-click on the tile you want to remove. You should see four options on you screen, click on the option 'Unpin from start'. If live tiles bother you, just choose 'Turn live tile off' and it will revert to a static tile.

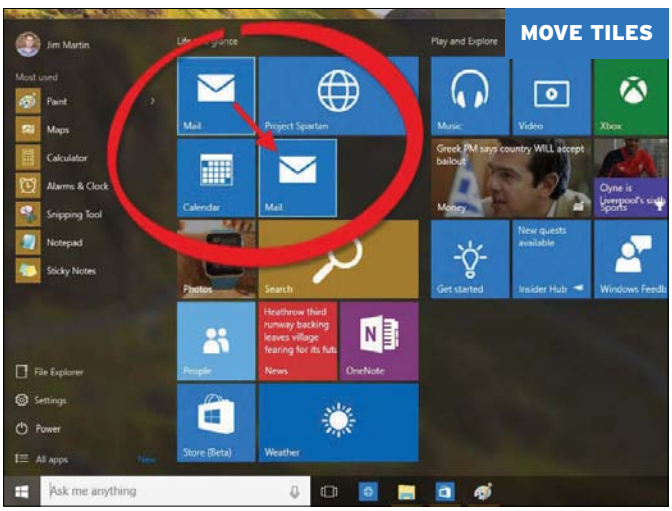
Resize a tile

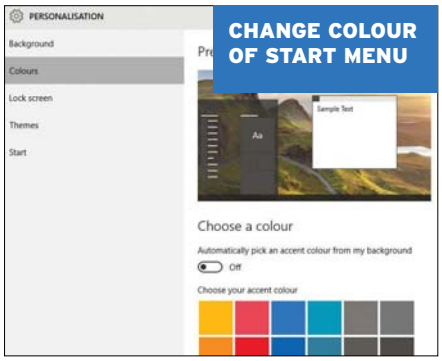
To resize a tile it's the same process. Right-click on the tile and then click or tap on the Resize option, and select the size you want. Not all sizes are available for all tiles, though.

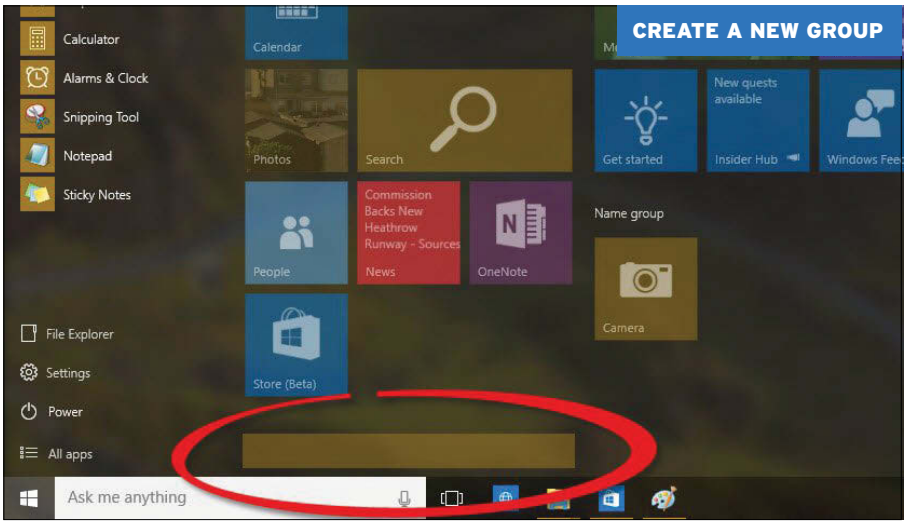
Rename a Start menu group

To rename a group, click (or tap) on the text that's already there and change it to something more meaningful. If there's no text, as with a new group, tap or click on the area where the text would be and the editing box will appear.









Create a new group

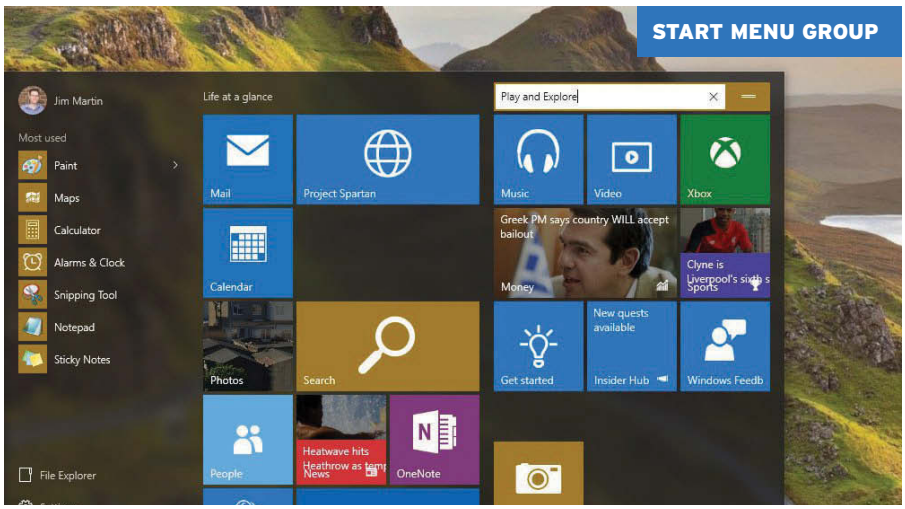
To add a new group, you must click and drag an existing tile to the top or bottom of the start menu. Once you see a change in colour (as in the image, right), you can release the button to allow the new group to be created.

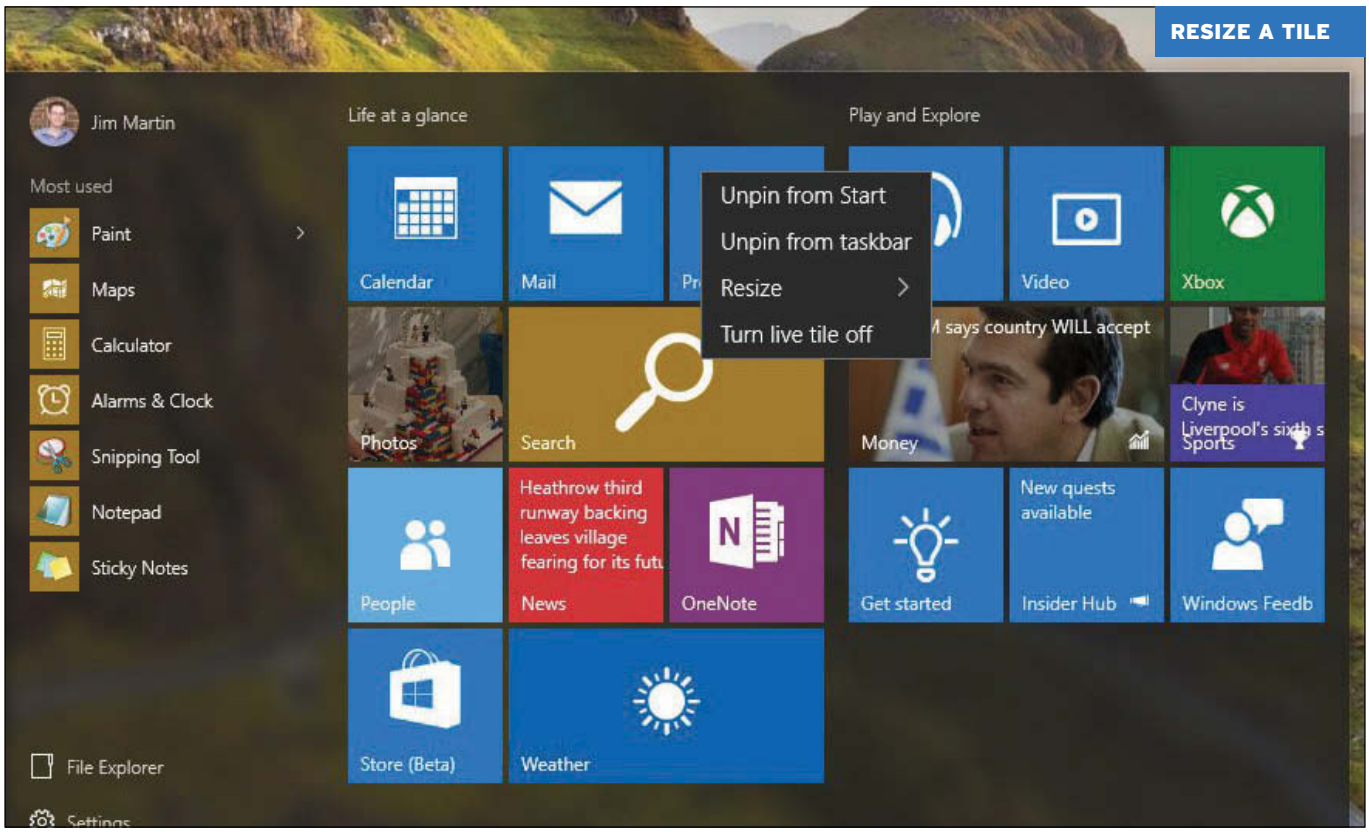
Change the colour of the start menu

By default, Windows 10 will pick an 'accent' colour from your wallpaper. In this case, the khaki tone isn't to our taste. But it's fixable.

On the start menu, click on the Settings button. In the new Settings menu, click on Personalisation. On the Personalisation menu, click on colours, then turn off the 'automatically pick an accent colour from my background' setting and choose the colour you want from the palette (see above).

Once you have picked a colour, scroll down to and turn on the setting called 'show colour on Start, taskbar and action centre. This will change the colour of the taskbar and the action centre as well as the Start menu to the colour you have just chosen. ☒





HOW TO USE CONTINUUM IN WINDOWS 10



Windows 10 has a clever feature called Continuum that knows which device you're using and switches the user interface to make it suitable for PCs, 2-in-1 devices, tablets, or even turns your phone into a PC. Martyn Casserly explains how it works and why it's so useful

It's fair to say that Microsoft made some bad choices in Windows 8, paramount of which was the touch-optimised interface. Forcing this strange and clunky method of control on the user was, in the most part, unwanted and certainly unwelcome. Windows 10 fixes most of these issues with a new feature called Continuum, which makes sure you always have the best interface for your device at all times. In this article, we explain what Continuum is and how to use it on your tablet, touchscreen laptop, and Windows phone.

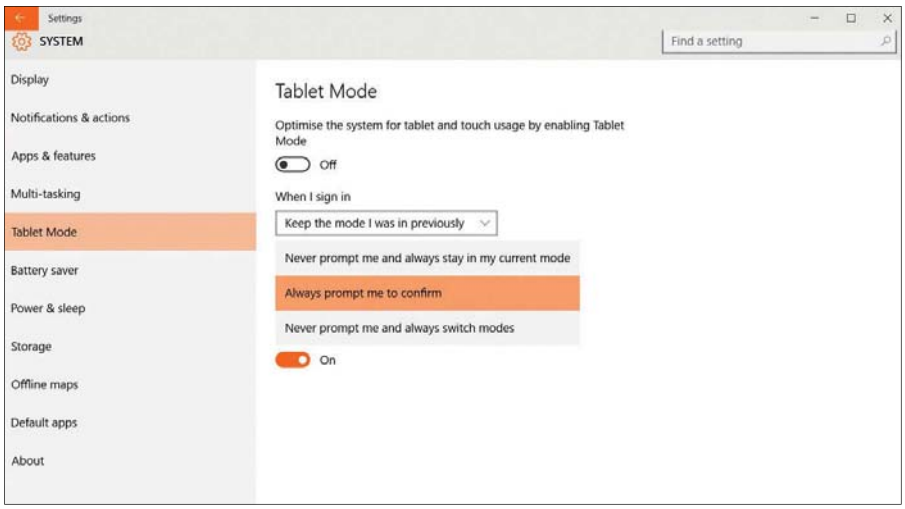
What is Continuum?

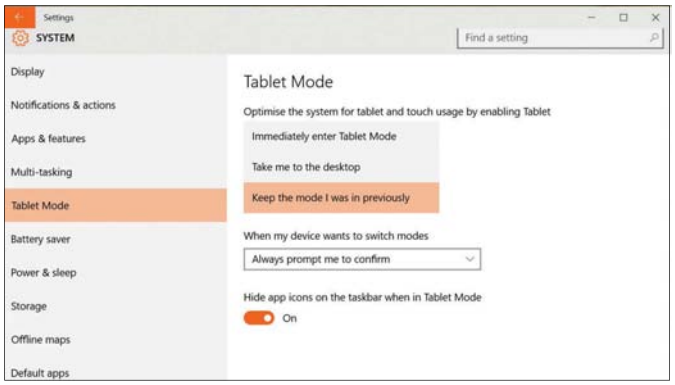
Continuum is a way for Windows to detect the hardware you are using and ensure that you always have the optimum interface on your machine. If you are using a desktop with no touchscreen, then Windows will now know this and present the traditional mouse and keyboard interface that works best on that setup. For those with a hybrid device, such as the Surface Pro 3, Continuum will monitor whether a keyboard is attached or not and provide either a tablet or touchscreen laptop interface. If you then remove the keyboard this will be detected and the interface adjusted accordingly by the system, and vice versa. It's simple and keeps out of the way, just like good software should.

It isn't just Windows itself that changes to suit your hardware; applications will also adjust to offer the best way to interact with them on the platform you're using. Microsoft has made this possible in a large part by the introduction of Universal Apps, which share the same underlying code (as do the various version of Windows 10) and are able to adapt to either a desktop or mobile interface without the need to launch a separate version.

How to use Continuum

As Continuum comes built in to all versions of Windows 10 there isn't much to do in terms of setup. If you have a traditional desktop or laptop your system will always use the same interface. For owners of tablets and hybrid devices there are options for controlling how your device responds to a







change of hardware, such as removing or adding a keyboard.

In Windows 10 when you remove a keyboard, for example, the system will pop up a dialog box asking if you want to enter tablet mode. Tapping this will then adjust the interface. Of course, the reverse is true when you reattach the keyboard. Rather than be prompted every time, you can select an automatic response so that Windows knows what you want it to do.

To find this open the Start Menu and go to Settings > System > Tablet Mode. Under the heading 'When my device wants to switch modes' you'll see a drop-down menu. Tap this and you'll see the following three options:

- Never prompt me and always remain in current mode
- Always prompt me to confirm
- Never prompt me and always switch modes

The first is in essence turning off the Continuum feature, the second is the default setting where you are asked every time if you want to switch modes, and the third is the automatic switching option. Experiment with which one works best for you, and of course you can change it at any time.

The other setting in this menu allows you to instruct Windows 10 which interface is the default one you want when you sign in.

Switching between modes

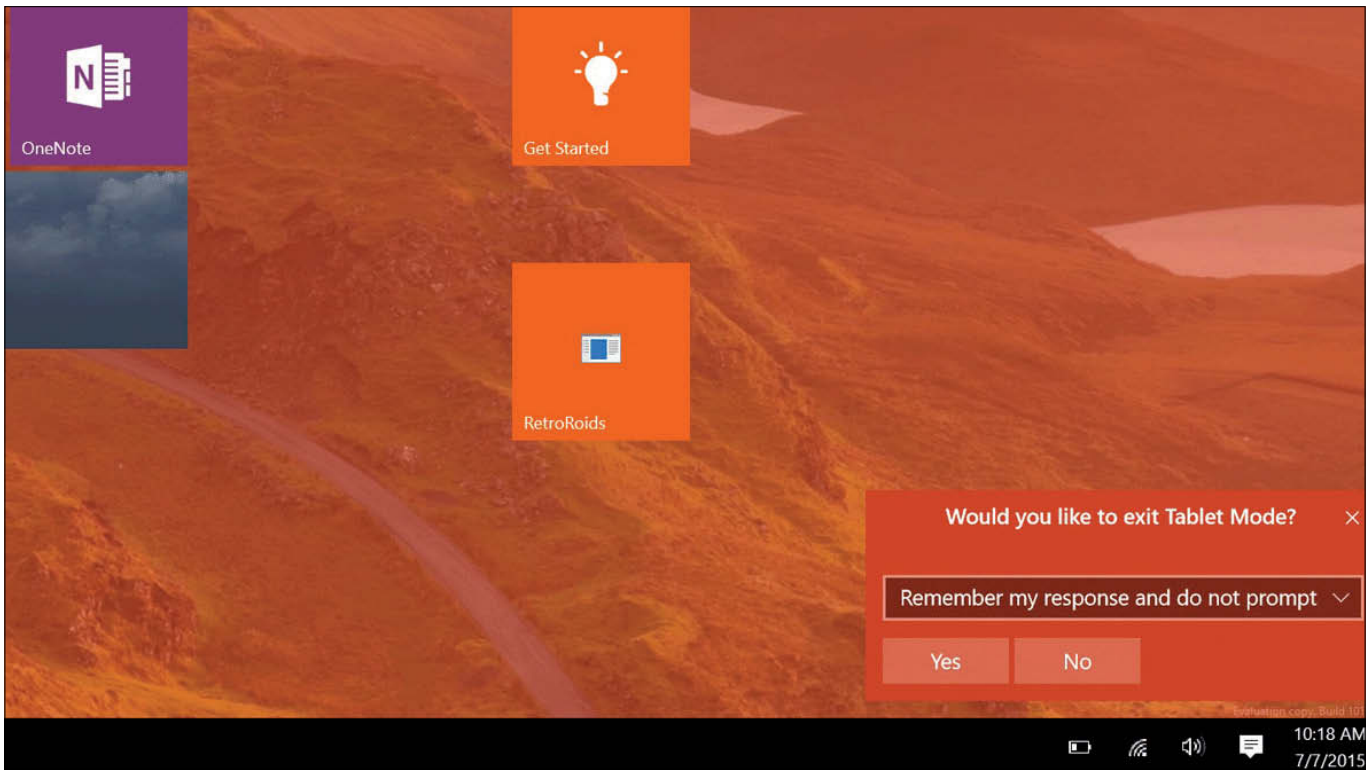
Whenever you switch between modes you'll find that the interface has different options. Entering tablet mode will mean that tapping the Start button (the Windows icon in the bottom-left corner) will launch the Window 8 style fully-expanded Start Screen. Menus are also available by swiping in from the left or right. The Charms bar is no longer around in Windows 10, so swiping in from the right reveals the Notification Centre instead.

To exit tablet mode you either reattach a keyboard or tap the Tablet Mode option at the bottom of the Notification Centre, which then asks you if you want to switch. It's all very quick, easy to use, and feels a long way from the pain of Windows 8.

Turn your phone into a PC

One of the most exciting parts of Continuum is the way it can turn a Windows Phone into a PC. Microsoft recently demonstrated how connecting a phone to an external monitor, keyboard, and mouse turns the universal apps on the phone into fully fledged versions of Office, Outlook, or other Microsoft applications. You can even run two things at once, independently on the phone screen and external display, so your kids can watch Netflix while you answer a call or catch up on emails.

Due to the new Qualcomm chips required for this advanced feature, Continuum on Windows Phone will be restricted to new device models set to be launched with Windows 10. Expect to see reviews of these devices, and a full explanation of how Continuum works on them, as soon as they are released. ☒



HOW TO USE CORTANA IN WINDOWS 10

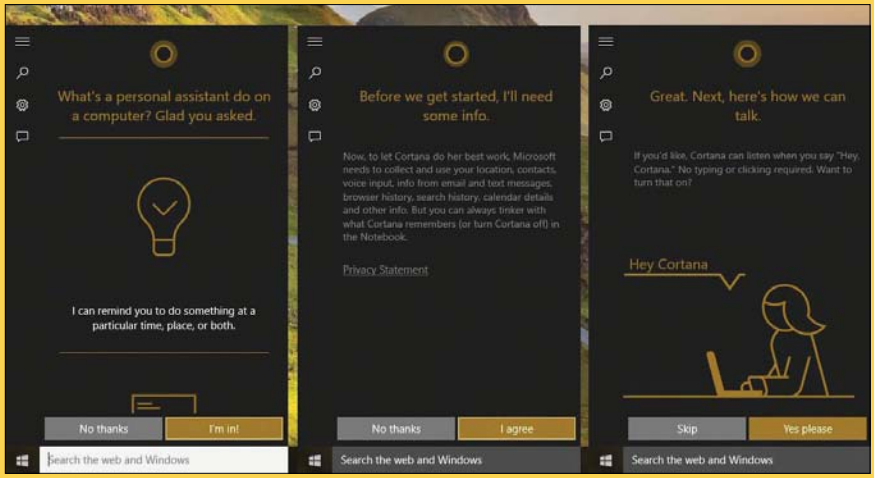
Microsoft's digital assistant is now on the desktop. Jim Martin shows how to use Cortana in Windows 10

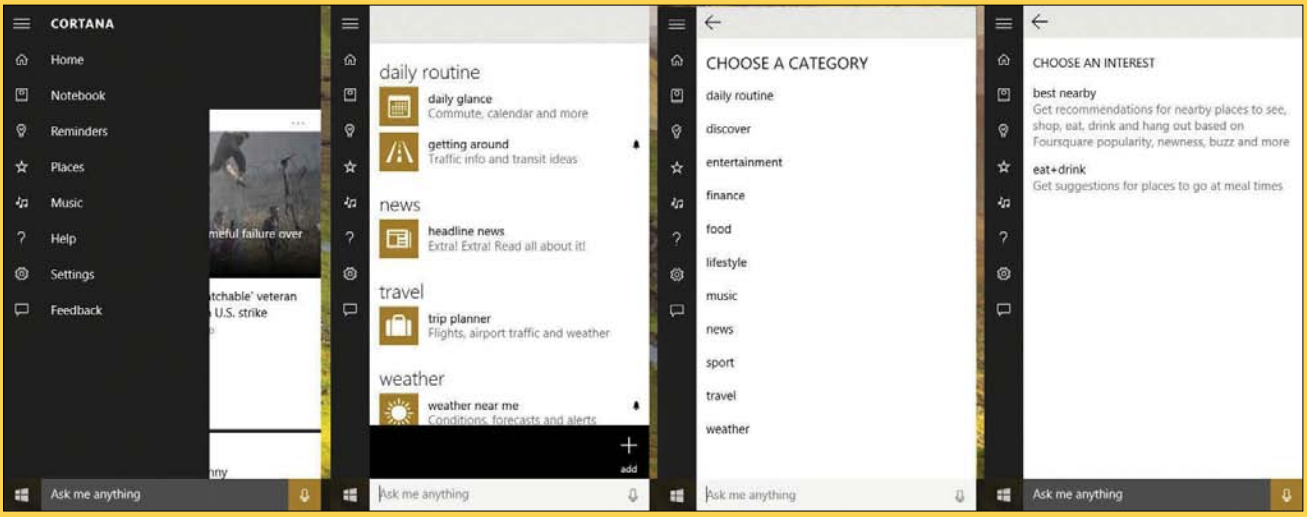
STEP 1

Click the search box next to the Start button (the Windows symbol) and a window similar to the Start menu will appear. Cortana should offer up her services: just tap or click 'I'm in' to start the setup process.

If you agree with the terms and conditions, click 'I agree'. If not, you can't use Cortana. There are privacy settings you can adjust – we'll get to those later.

Finally, decide if you want to be able to say "Hey Cortana" to invoke the assistant without having to click in the search box.





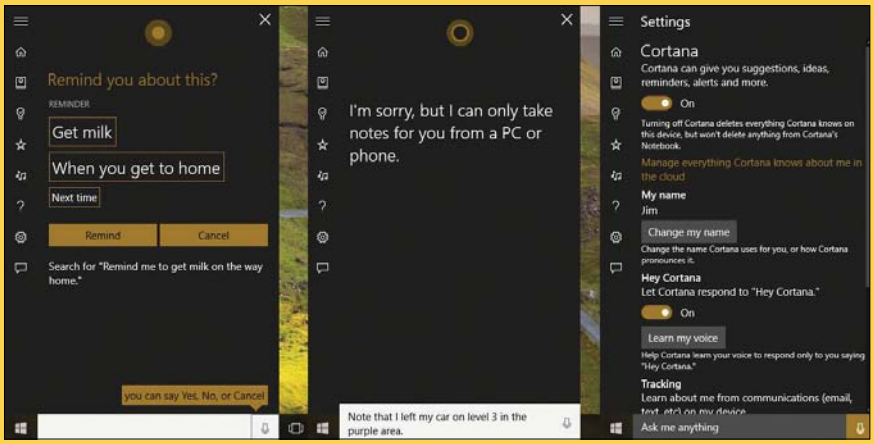
STEP 2

Next type in your name or a nickname and click 'Use that'. You'll then see Cortana's default view, which displays the top news stories to begin with. You can then type or tap the microphone icon to enter a question or command. For example, we typed "What's the weather going to be like this weekend?" and Cortana displayed the forecast for Saturday and Sunday.

STEP 3

For Cortana to be truly useful – and personal – she needs to know more about you. Click the hamburger (the three horizontal lines) at the top-left corner of the Cortana window to show the menu. In fact, the menu is always on display; clicking the hamburger just shows you what each icon does. You can see the menu descriptions in the left-most image below.

To tell Cortana about your interests, click the Notebook section. Each item in here is customisable, and you can include more categories by clicking the '+' button at the bottom. When you do, you'll see a list of categories. We clicked 'food' and got the two options shown on the far right.

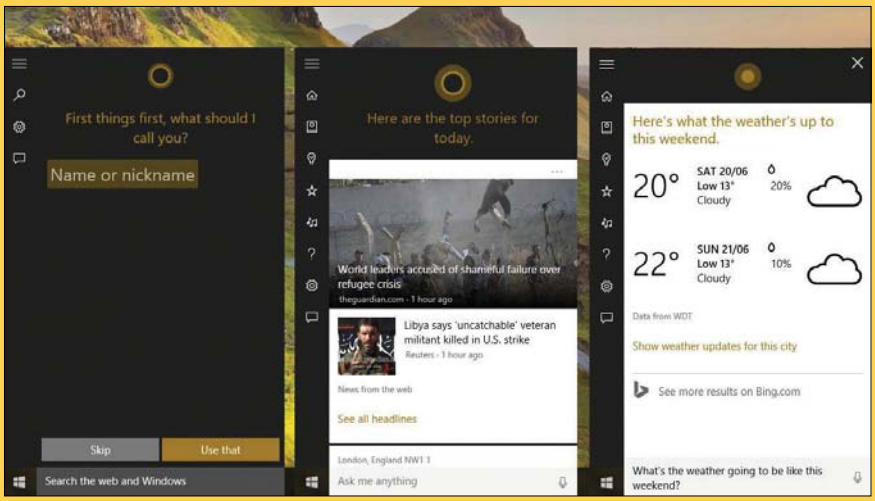


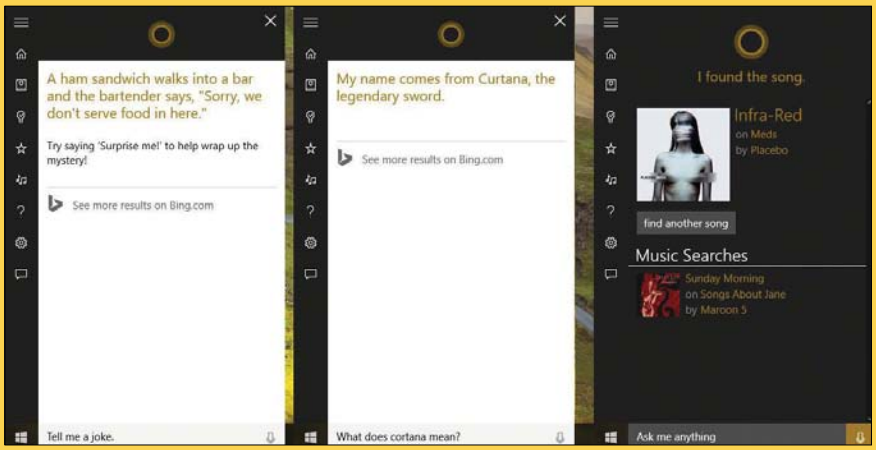
You can add as many of these as you like. Click Sport in the category menu and you can add your favourite team to get notifications. However, this is still (as it is in Windows 8) very limited in the UK. You'll find football teams but not much more.

STEP 4

To fine-tune Cortana and choose privacy settings, click the cog icon in the left-hand menu. You can change your name, choose how Cortana pronounces it and more. Under the tracking section, you can set whether or not your emails, text messages and calendars are mined for information. If you allow it, Cortana can tell you when to leave for a meeting or about traffic delays that might make you miss a flight, for example.

You can use Cortana to make quick notes (a feature not working in this build – see the middle screenshot above), and to set reminders by place, time or person.





STEP 5

If you want to know what music is playing, tap the musical notes icon and Cortana will listen and identify the track. Previous searches are shown in a list, too (below, right).

As on Windows Phones, you can have a bit of fun with Cortana as well. You can ask her to tell you a joke, or even ask about her. Oddly, her answer was different from that on a Windows Phone when asked what Cortana means. You can also get it to set alarms, which will sync with your Windows Phone (as long as it too has Cortana), ask for directions to places and search the web. ☒

HOW TO USE UNIVERSAL APPS IN WINDOWS 10

Windows 10 Universal apps work on PCs, laptops, Windows Phones, tablets, and even your Xbox One. Martyn Casserly takes a look at these cross-device apps explains how to use them

With the release of Windows 10 mobile just around the corner, it won't be long now until you can try out the new Universal apps across all their devices. We've had a play with some early versions and here explain how to use Universal apps in Windows 10 and which apps you can expect to see in the near future.

What are Universal Windows Apps?

Universal apps (or Windows Apps as Microsoft recently renamed them) are ones that can work on any Windows 10 machine – be it a PC, tablet, phone, or even your Xbox One once the Windows 10 update arrives in the autumn for the console. The tech giant has made this possible by using a common Windows core across all the new devices, which makes it a lot easier for developers to create apps without needing to rewrite them for each platform. This could quickly close up the perceived app gap on Windows Phone, and see a thriving ecosystem evolve on Microsoft's mobile platforms.

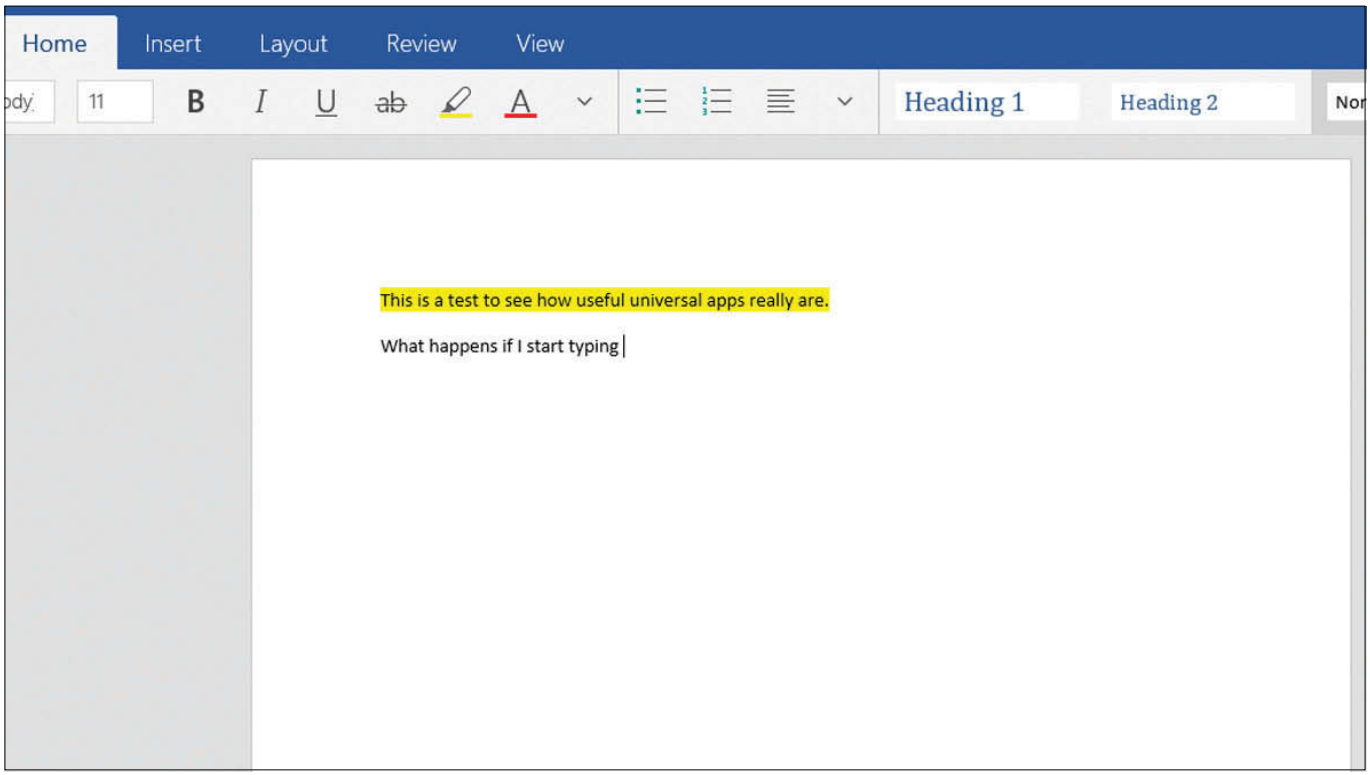
The principle behind Windows Apps is one of convenience. Let's say, for example, that you're out and about and you have a great idea on how to improve a document you were working on that morning. Simply pull out your Windows Phone, launch the new Word app and you'll be able to edit, create, or format the document there and then. When you get back to your PC all the changes should already be applied and you can carry on where you left off.

Of course, this principle isn't entirely new, as web services and cloud syncing have already made these kind of the features available in Google Docs, Apple's Pages and a variety of other third-party products. But if you have a combination of Windows 10 products you will now be able to take advantage of universal apps right out of the box as Music, Maps, Photos, Outlook Mail, and Calendar will all come preinstalled on new devices once Windows 10 is launched, with Word, Excel, and PowerPoint included on mobile devices. PC users will also have the simplified tablet versions of Office available to download for free from the now unified Windows App Store, although the fully featured Office suite will still be a paid for option – one compatible with the mobile versions.

> Universal apps (or Windows Apps as Microsoft recently renamed them) are ones that can work on any Windows 10 machine – be it a PC, tablet, phone, or even your Xbox One



At the moment, OneDrive seems to be the glue that holds many of these apps together, with the Office suite saving to the cloud service by default. Whether this remains true for non-Microsoft software remains to be seen, although Dropbox has already released its universal app and obviously that uses its



own cloud storage service, so the indications are that it could be an open platform.

Experimenting with Word

To try out this new version of Office we visited the Windows Store on a PC and smartphone, both of which have the Windows 10 previews installed. Downloading the Word preview, we found that the layout was clean and similar on both devices. To test the syncing features we first opened the phone app, created a new document and began writing. Tapping the three dots at the bottom of the screen opened up the formatting menu and allowed us to easily highlight the sentence we had written.

We then opened the Word preview app on our PC, looked in the recent documents section of OneDrive, and found the file we began on the phone. After loading it up we were presented with the same format and highlighted text – as you'd expect.

We then added another sentence, while keeping the app open on our phone, and seconds later the changes appeared on the mobile app. It was all very simple, trouble free, and easy to use.

Haven't we seen this all before?

In short, yes. Google Docs has long worked in this way, although it's a web service, so as long as your device has a web browser and a live internet connection, it can access Google Docs. The brilliance of Google Docs is that it not only works across multiple devices, but multiple users can collaborate on one document in real-time, with changes appearing on every user's screen instantly.

Apple also has a similar 'universal' system that it calls Continuity, and at the moment it seems to work a bit better than Universal Windows apps. This is because when you're working on a document or an email on your iPad or iPhone, just bringing the device close to your Mac will give you a gentle prompt in the dock (OS X's taskbar) to let you know that there is something synced.

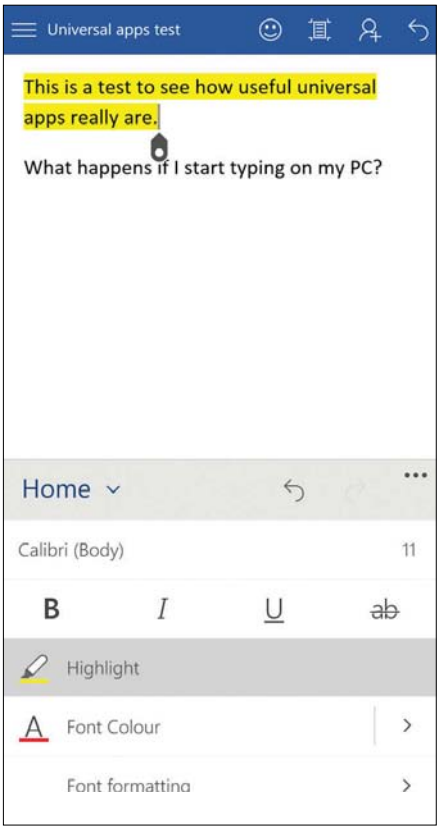
Clicking on this prompt will open the relevant app and display the thing you were working on. It's very clean and feels that bit more automated than the current Windows offering. You don't even need to have saved the document you're working on, as the operating system works out what you're doing. That's not to say it's perfect, and we experienced a few apps not opening up while conducting this test.

Obviously Windows 10 is still being polished, but hopefully Microsoft will enable this kind of helpful compatibility. For now though, a single app store, with fully compatible offerings across all devices, is something that we're looking forward to spending a lot more time with.

Which apps are available?

It can be a little difficult to work out which apps in the store are universal, as searching for the term only returns offerings with the word in their title. We're hoping that Microsoft will create a section similar to the one Google uses in its Chrome Store to denote which apps can be used offline.

This would certainly make life easier for the user. In terms of apps we know about, as we've stated above, Microsoft has already outlined a wide range of its own apps, with the Office suite, Music, Outlook Mail, Photos, Calendar, and OneNote. Other big players are lining up their own with Adobe releasing Photoshop Express, and various notable creations from Dropbox, Foursquare, Autodesk Pixlr, Netflix, Twitter, and plenty more. ☒



HOW TO USE THE EDGE WEB BROWSER

Edge is Microsoft's replacement for Internet Explorer in Windows 10. Fast performance and smart looks combine with advanced features such as web page annotation and reading lists. Martyn Casserly walks you through how they work and reveals why you'll want to use them

In Windows 10, Microsoft has broken with tradition and included a brand new browser to accompany Internet Explorer. The Edge browser is a fast, modern, feature-enhanced approach to the internet, which could tempt users back from Google's increasingly popular Chrome browser. Edge was still in beta when we wrote this, but it will include Microsoft's Cortana search assistant, alongside reading list and reading mode capabilities, plus the ability to annotate and share web pages.

Reading Mode

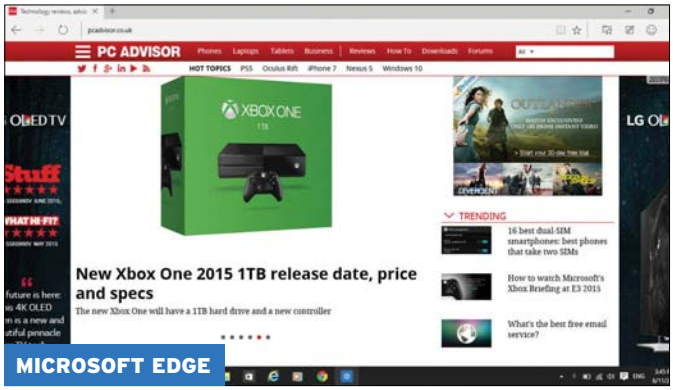
One of the most useful new features is the Reading mode. Sometimes you want to strip away the distractions when you're trying to read an article, and this simple tool opens up a reformatted version of the page you're reading, removing everything except the text and associated images. It doesn't work on every site, but you'll see an icon when it is.

To access the mode, you'll need to click on an article – remember this won't work on a home page, as that has lots of links to other content and will just confuse the browser – then go to the upper right section of the browser where you'll see an icon that looks like an open book. If the Reading mode is available it will be in bold, otherwise it will be greyed out. Click on this and you'll now have a clean and easy to read window with the article inside.

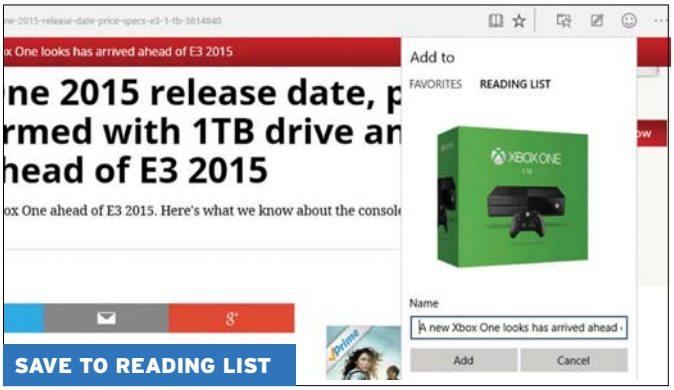
Reading List

Keeping up with all the interesting articles you find, or that people share with you, can be a Herculean task. Leaving various browser tabs open so you can come back to them later is one way to keep track, but it's hardly ideal. In recent years apps such as Pocket and Instapaper have given you the ability to save these articles until you have time to read them; now you can do that directly from the Edge browser thanks to the Reading List feature.

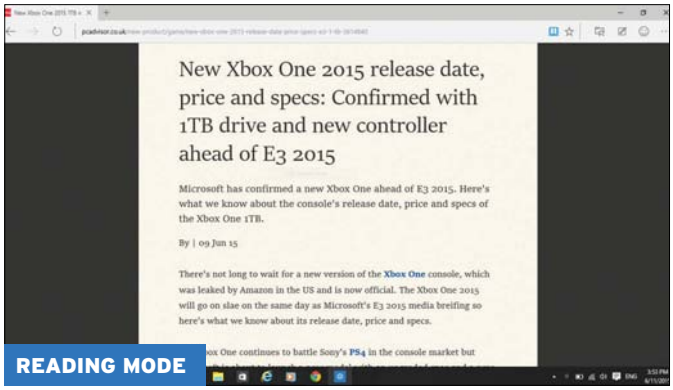
To use it, navigate to the web page that interests you, then click on the star at the far right of the search/address bar. A pop-up box will appear with two options along the top – Favourite and Reading List. Click on



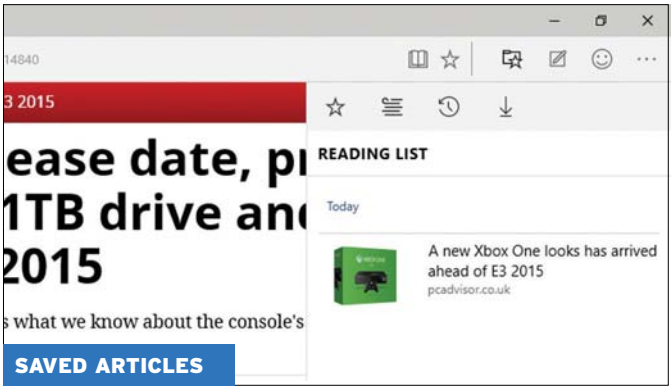
MICROSOFT EDGE



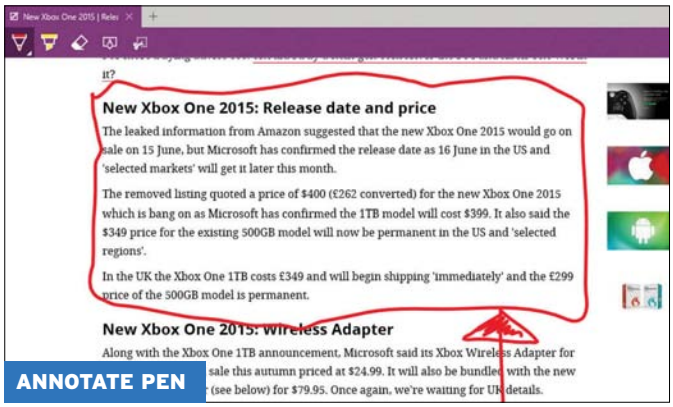
SAVE TO READING LIST

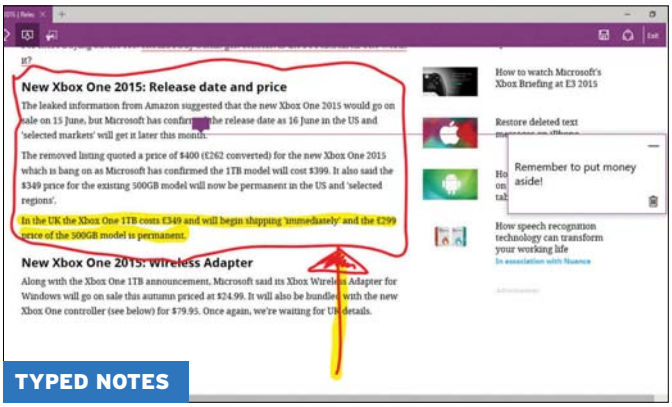


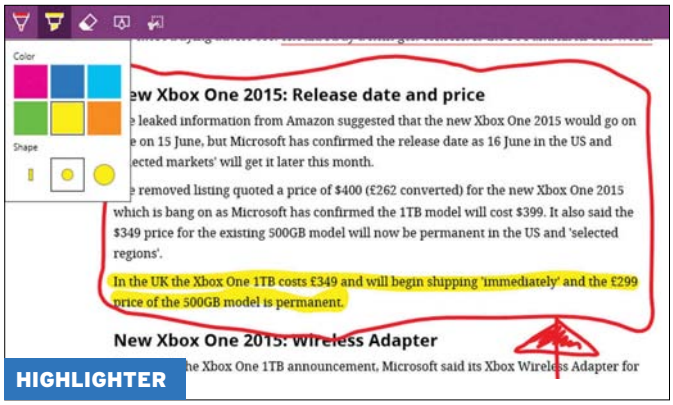
READING MODE

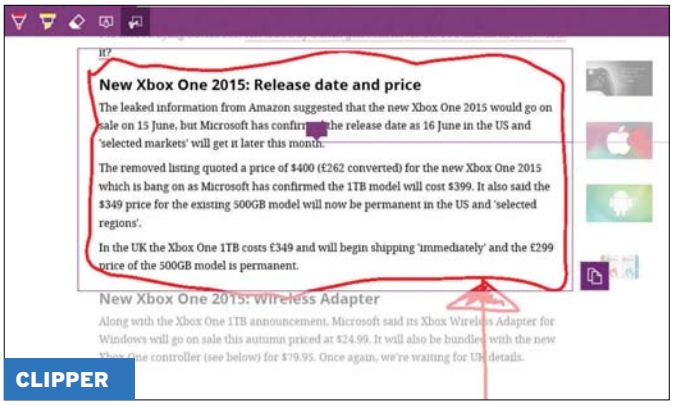


SAVED ARTICLES









Reading List, give the article a name you'll remember, then click Add.

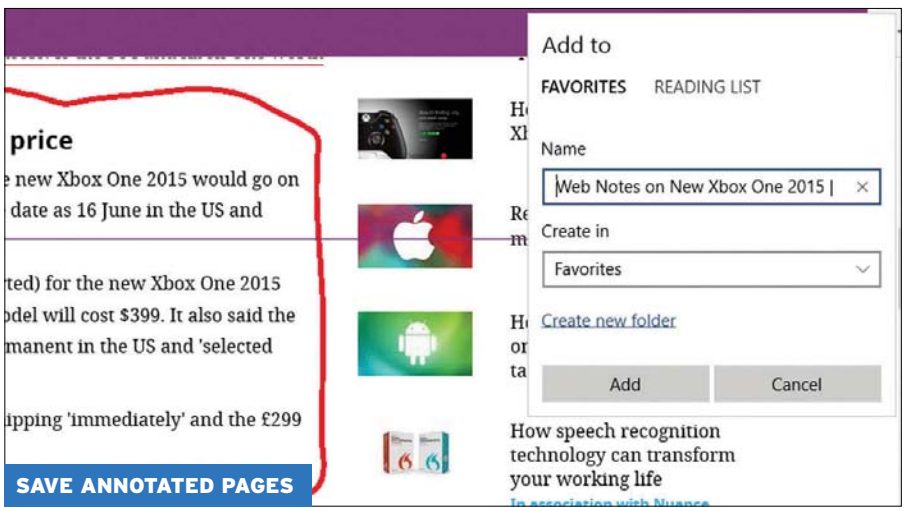
Then when you find you've got a few minutes to spare, click the icon to the right of the Reading List (the one that looks like a folder with a star). At the top of the box that appears you'll see four icons – a star, a pile of lines, a clock, and an arrow – click on the pile of lines to access the Reading List and you'll find your saved articles.

Annotate and share a web page

Another impressive feature of Edge is the ability to annotate web pages without needing a plug-in or add-on. If you want to highlight and share something, or maybe just a particular detail you want to remember, then click on the icon to the right of Reading List, which looks like a square with a pen inside. You'll see that the top bar has now turned purple (no doubt to emulate Microsoft's OneNote colour scheme) and a few new icons have appeared on the left-hand side. We'll look at each in turn.

Using the Pen feature

The first option is a pen that allows you to scribe whatever you please on the web page. Clicking on the icon brings down a menu from which you can select the colour and thickness of the lines the pen will make. When you've made your choice, you can scribble things on the page. If you have a touch-enabled device, or a Microsoft Surface, then you can draw using your fingers or a stylus; otherwise your mouse or trackpad will work just fine.



Using the Highlighter

In similar fashion to the Pen, the Highlighter has a drop-down menu with colour and style options. It also operates in the same way, marking anything you drag the cursor over

Using the Eraser

When we tested the browser, the Eraser was rather erratic. In principle, you treat it as you would expect, by selecting the tool then using it to remove any erroneous annotations. We expect this to be fixed by the final release.

Using Typed Notes

To the right of the Eraser, you'll see a speech box with an 'A' inside. This is a useful way to make notes on a page without drawing all over it. Select the tool and your cursor will turn into a cross. Click in the position that you want the marker to appear, then add your thoughts in the linked text box.

Using the Clipper

The last annotation tool is a straightforward clipper. With this selected you can highlight any part of the page and copy it into the clipboard. Then you can paste it into documents, emails or a variety of other apps.

Saving your annotated web page

On the right-hand side of the purple bar you'll find a couple of icons. The first is a diskette with which you can save your annotated web page. Click on this and you'll be given the choice of adding it to either your Favourites folder or Reading List. ☒

HOW TO USE VIRTUAL DESKTOPS IN WINDOWS 10

If you're constantly switching between apps, virtual desktops will help. Martyn Casserly reports

Virtual desktops have been around for a long time on Linux and Mac OS X. In fact they've also been built into Windows for many years, but gaining access to them required special software. Now, with Windows 10, they will be available without having to install extra software.

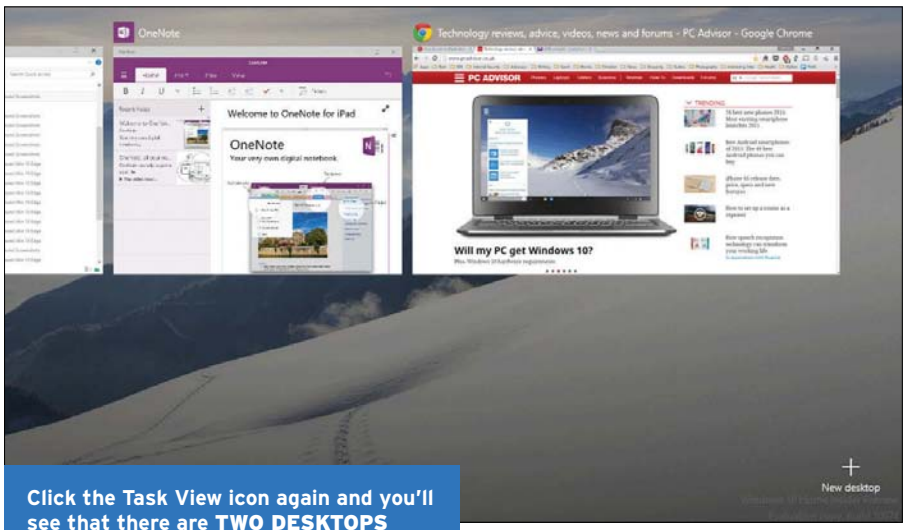
What is a virtual desktop?

If you have a single monitor attached to your PC or use only your laptop's built-in screen, you have one screen – the desktop – on which to run all of your software. This is fine if you only hop between a browser and a program such as Microsoft Office, but if you have lots of applications open things can get a bit confusing or just plain cumbersome. Virtual desktops are a bit like having lots of monitors: you can create different workspaces (screens) where you can arrange apps; so if you want one for work-related apps and another for leisure, you can do that.

As they're virtual they still share all the same data, files, everything, and you can move apps between them easily. It's just a convenient way of grouping together related applications and tasks. You can't break anything with them, and they can be very handy, so it's worth giving them a go.

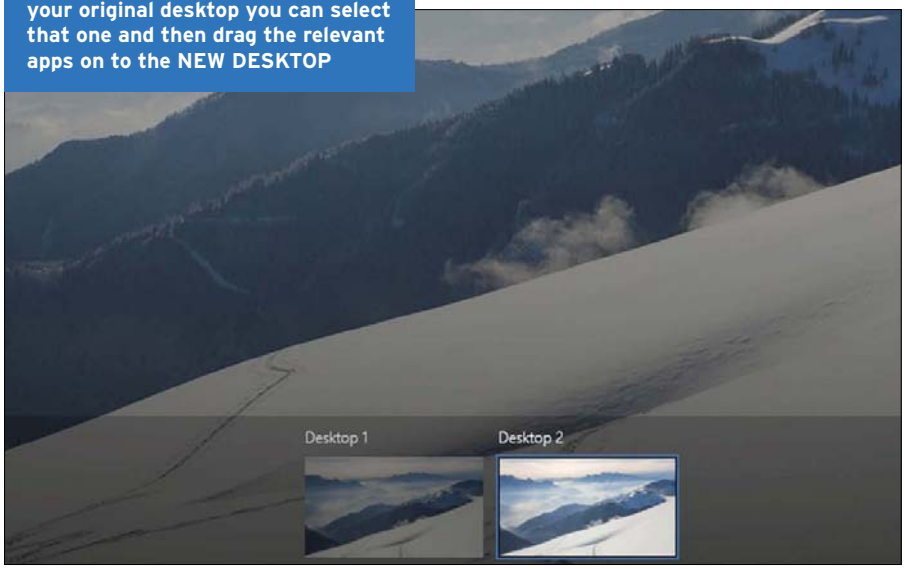
Creating a virtual desktop

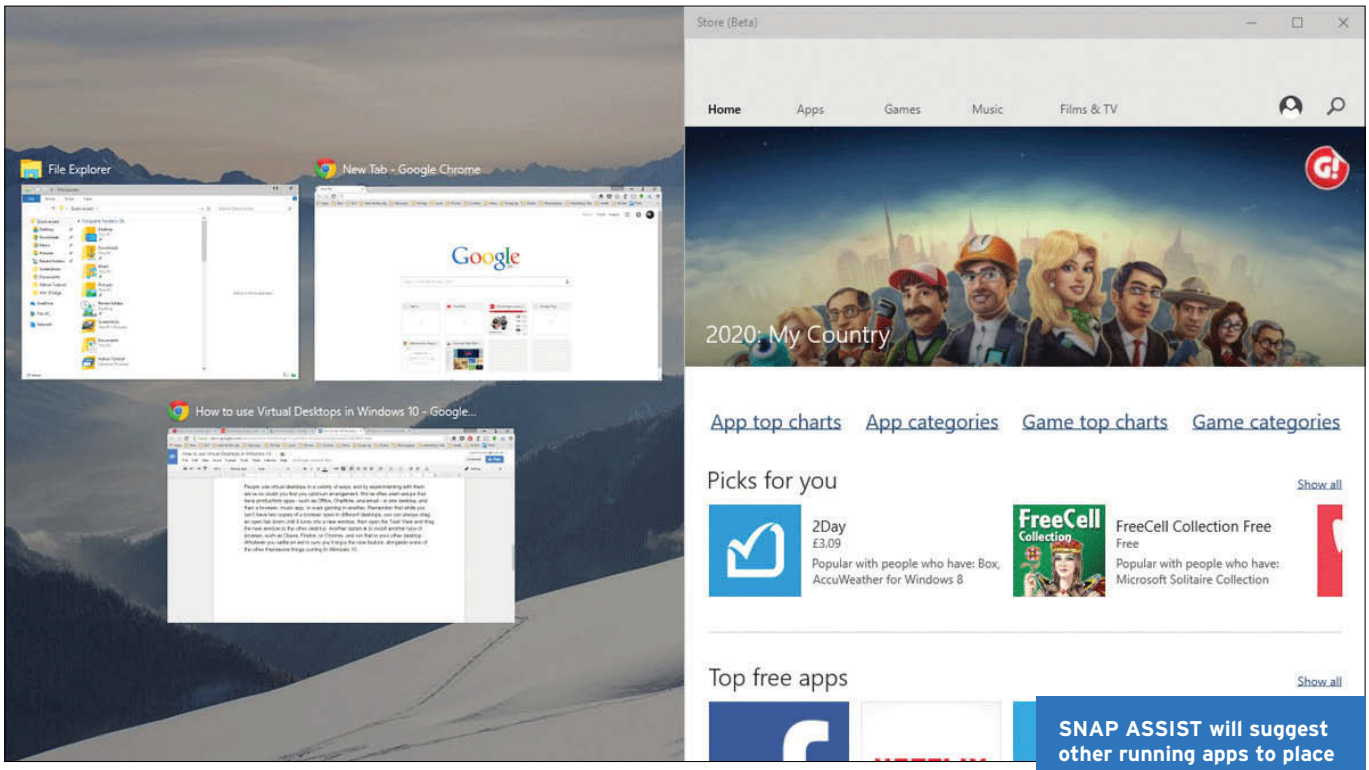
In the taskbar of Windows 10, you'll see a new icon to the right of the search bar that looks like a rectangle with two smaller ones slightly behind it. This is called Task View, and clicking it will give you a thumbnail view of all the programs that are running. The same thing can be achieved by using the key combination of Win+Tab. When in Task View mode, you'll see an option in the bottom-right corner that has a large '+' sign with 'New Desktop' written below. Clicking on this will create a



Click the Task View icon again and you'll see that there are TWO DESKTOPS shown at the bottom of the screen

If you have apps already running on your original desktop you can select that one and then drag the relevant apps on to the NEW DESKTOP





SNAP ASSIST will suggest other running apps to place in the remaining desktop

new desktop, one that looks and behaves identically to your normal one, but has no apps running on it.

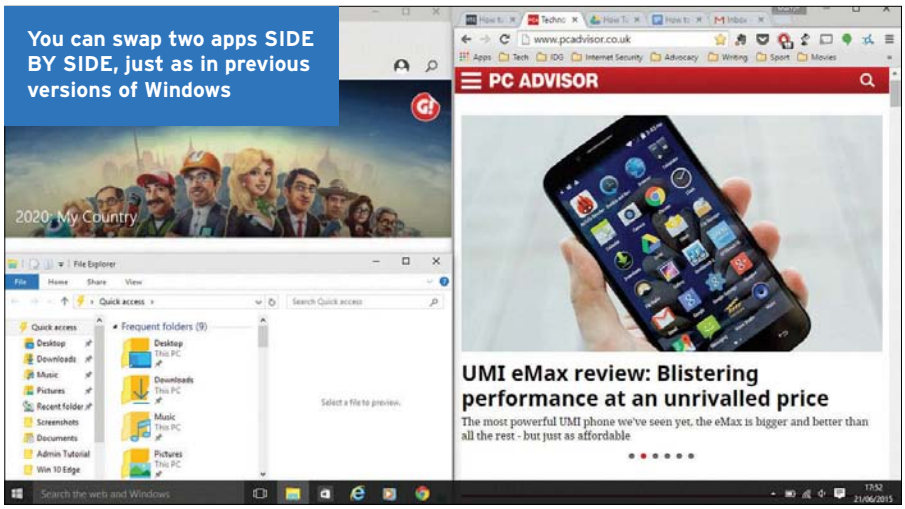
How to switch between desktops

You can easily switch between these different environments by either clicking on them in the Task View menu or using the combination of Ctrl+Win+either the left- or right arrow key. Jumping straight to an app is the same as it ever was, with the Alt+Tab combination showing all apps open on all desktops.

At the moment, you can create multiple desktops, but functionality is somewhat limited. You can't change the wallpaper of one desktop without all of them changing, and clicking on an app that is running in another desktop will simply take you there rather than launch a new instance. Microsoft will no doubt continue to add features and hopefully some of these limitations will be removed.

The benefits

People use virtual desktops in a variety of ways, and by experimenting with them we've no doubt you'll find your optimum arrangement. We've often seen setups that have productivity apps – such as Office, OneNote, and email – in one desktop, and then a browser, music app, or even gaming in another. Remember that while you can't have two copies of a web browser open in different desktops, you can always drag an open tab down until it turns into a new window, then open the Task View and drag the new window to the other desktop. Another option is to install another type of browser, such as Opera, Firefox or Chrome, and run that in your other desktop.



You can swap two apps SIDE BY SIDE, just as in previous versions of Windows

How to use Snap Assist

When it comes to arranging what's on your screen, Windows 10 has improved 'snapping'. In Windows 7 and 8 it was possible to automatically resize windows to cover half the desktop by simply clicking and holding on the top part of a window and dragging it either to the left, right then letting go. In Windows 10 the feature is called Snap Assist and has new tricks.

Now when you're in an app and press Win+either the left- or right arrow, you'll see the app take up half the desktop and show you all the other open apps that can join it on the other side of the screen. To select a partner just click on it and you'll have a split screen with the two apps nestled side by side.

If you prefer to use a mouse, click and drag an app using its top bar to the middle of the left- or right-hand edge.

That's not all, though. When you have a window selected you can also press WIN+up, down, left, or right and it will resize to either the whole side of the screen or a quarter, and you can move it around to the different sides of the screen using the keys. This allows you to create a grid that has four windows open, each one occupying a quarter of the display.

To do this with a mouse, simply drag the application to one of the corners until it fills a quarter of the screen.

Obviously on a small or low-resolution screen this won't be as useful, but if you have a large monitor, then this quick way of arranging apps should become a regular part of your workflow. ☒

SOLID-STATE DRIVES

If you're thinking of upgrading your PC, a solid-state drive is a great option if you want to boost its performance. Andrew Harrison looks at six of the best

Solid-state is standard-issue for storing data in tablets and smartphones, where it's relied upon for its tiny size and knock-proof nature. Those same assets can be handy in desktop and especially laptop PCs too, but traditional computers also have the pace to really unlock SSDs' most talked-about virtue – their incredible speed.

Instead of a fragile magnetised disk whirring at 90- or 120 times every second, SSDs store binary data on shock-resistant silicon chips. Some people use the word 'memory' when they mean storage, but the lines are confused with NAND flash technology, which is non-volatile memory. In other words, RAM that keeps its memory even after you switch off the power.

And besides being physically robust, silent, and smaller and lighter than any hard-disk drive, the big incentive to go flash remains sheer data-hurtling performance. The bits can simply be read and written hundreds and thousands of times faster from electric flash memory. This speed factor is about so much more than go-faster bragging rights, though. Old-school desktop PC users may still battle over who has the fastest processor or the hottest graphics card, but SSD performance is more about the overall user experience – applications launch almost instantly, web pages spawn faster, and files copy in a fraction of the time.

Put simply, and regardless of whether your processor has the number 3, 5 or 7 after the 'i', the whole computer responds so much better to your touch. The main drawback in the past has been the extortionate price of entry to the premier-class storage club.

Until recently anyway. It's taken six years or more, but we are now at the state where the solid-state drive, the SSD, is a truly affordable component for any computer user. And if your wallet won't even stretch to £100, just juggle your byte budget instead and get a 256GB drive for £70 or less.

Performance has swelled over the years – not just in the drag-race test of copying big files, but crucially with the way that small files are handled. And also in the way that a drive maintains itself, forever pruning and sweeping up the garbage of deleted files in the background.



Photography by Dominik Tomaszewski

Much of the background housekeeping of a modern PC operating system is with the incessant background reading and writing of small files of 4kB or less. It's the random access to these all over the platters that can choke old disks that need to physically move a pickup head across spinning platters.

We have reached a point where just about any SSD you put into a computer to replace a hard disk will transform your experience. But for performance seekers such as professional workstation users, there's still a case for finding the fastest. And that fastest metric is now more about small-file transfers, which we can measure by the number of input and output operations capable in one second – otherwise known as IOPS. The best SATA-based flash drives are returning peak figures around 100,000 IOPS, made possible by the way that datastreams can be paralleled together, a major asset of flash over disks.

Buying an SSD for your computer

Performance – in terms of the speed with which data can be read and written – has now in effect plateaued among the best SSDs. It's not that flash memory has reached its limit, far from it, but the Serial ATA interface between the flash and your computer is now an increasingly narrowing bottleneck.

Pioneered by Apple, and now finally trickling into the Windows world are solid-state drives that put SATA in the waste bin, flash storage drives that hook more directly into the PC's native PCI Express bus. But Apple Macs take a proprietary version of these cards that are not available to buy or upgrade; and Windows PCs that are now available with the necessary M.2 PCIe attachment are currently thin on the ground.

So for the moment, if you're building or upgrading a PC, chances are you'll be turning to the old tried-and-tested Serial ATA Revision 3.0 interface; often mistakenly called SATA III. This bus has a 6Gb/s (750MB/s) nominal speed, but circa-550MB/s real-world ceiling.

Despite current SATA SSDs' shortcomings and converging performance specs, we have tested the speed of this group of six, both in large-file sequential transfers and small-file random access, as differences do exist between brands and models. Our selection covers the highest-performing SATA SSDs today, as well as some cheaper models that juggle the value factor rather than best-in-class performance figures.

When buying an SSD, look out for long warranties and high write limits if you prize data integrity, although with the help of proper backup routines, data loss is less of an issue today. Different SSDs demand more or less power in active use or when idle, and there are different power ratings again for when a laptop is in a sleep or hibernation mode. Unfortunately, we don't have the capability to measure power consumption in-house, and each manufacturer has its own way to present its numbers in the best light, so we can't give a meaningful rundown of which has the best power economy.

Do look out for manufacturers that provide accessible support with firmware updates possible on the platform of your choice. Most storage brands are still firmly routed in the Wintel world, although with the decline of that platform more drive makers are making cross-platform upgrade tools available, in the form of bootable ISO images you can download from their support sites.



CRUCIAL MX200 1TB

£301 inc VAT • uk.crucial.com

Support	★★★½☆
Performance	★★★★☆
Value	★★★★☆
Overall	★★★½☆

Crucial has become one of the go-to brands for SSD upgrades since the technology became relatively affordable around five years ago. Over that time, we've seen the C300 launch in 2010, the M4 the following year, then the M500 in 2013 and M550 in 2014. More recently, the MX100 was quickly followed by this year's MX200 and BX100 together – splitting the single line into two products. The BX100 is aimed at the budget end of the market; the MX200 meanwhile now stands as the brand's best SSD at this time.

A winning formula was devised early on in all the above drives, using NAND flash chips from the brand's parent Micron Technology, run by a Marvell controller, and with Crucial's own firmware on the controller. In the case of the MX200, we have the same Marvell 88SS9189 controller that powered both the MX100 and the M550, now allied to 16nm Micron multi-layer cell (MLC) NAND flash.

As with the previous generation there is Adaptive Thermal Protection, which will reduce performance when internal sensors detect high temperatures, while Power Loss Protection is designed to reduce the chance of data loss in the event of a sudden switch-off, using small onboard capacitors to maintain power long enough to write data from DRAM cache to NAND.

Redundant Array of Independent NAND (RAIN) is said to protect your data at the component level, similar to how RAID is used with multiple hard drives. The need for this may be greater than ever with the tiny 16nm-process NAND, since the downsizing process also leads to lower reliability.

New to the MX200 series is Dynamic Write Acceleration, a way to include a faster write cache using single-layer cell (SLC) flash. This is available on the smaller 128- and 256GB capacity drives only though, and not included on 512GB nor the largest 1TB sample we tested; presumably because additional parallelism and over-provisioning make it unnecessary here.

Performance

In basic sequential data transfers the Crucial MX200 comfortably exceeded the 500MB/s mark, reaching 548MB/s for reads and 514MB/s writes using the simple ATTO disk benchmark test.

A run with CrystalDiskMark confirmed what has long been apparent with Crucial's choice of Marvell controller, that there is no slowdown in performance when faced with incompressible data like MPEG and JPEG files: when writing randomised data, the Crucial could read and write at around 438- and 480MB/s respectively.

Tested with 4kB random data, the Crucial showed reads at the typical 29MB/s level, while 4kB random writes were the highest in our tests at 131MB/s. When stacked up to 32 queue depth the drive didn't scale as well as others, turning in just 102MB/s reads where other models could reach 300- or 400MB/s. This translated into weak read IOPS results of around 26,100, although the 90,100 write IOPS result was closer to the rest of the pack.

Turning to AS SSD, which uses 64 threads of incompressible data, the Crucial reported slightly better results of around 68k read IOPS and 79k write IOPS. The benchmark's final nominal score of 954 points is good but here in the lower half of results in this group of six.

VERDICT: When we tested the Crucial M550 last year, it had a price/storage quotient of 37p/GB. The latest MX200 is available for around 30p/GB, but other than that little has changed, except the newer drive has smaller process 16nm flash. It's still a good drive, but it's lost a little headway against higher-performing competitors



INTEL SSD PRO 2500 240GB

£126 inc VAT • intel.co.uk

Support	★★★★☆
Performance	★★★½☆
Value	★★★☆☆
Overall	★★★½☆

Intel was an early prime mover in solid-state drive technology, applying its semiconductor know-how to make some respected SSDs in the days before they became more affordable and popular. Today's Intel SSDs have forsaken innovation and are more derivative, and in the case of the SSD Pro 2500, we find that Intel is no longer using its own silicon anywhere. For the main NAND flash chips it is buying from South Korean Hynix, while the key controller technology is supplied by Seagate SandForce.

The SSD Pro 2500 is aimed at business users and consumers that want to add an extra layer of security with a self-encrypted drive (SED). This is available with most SSDs as an encryption routine that is accessed through the BIOS of PCs running Windows or Linux, but is perhaps not the easiest way for an unskilled user to secure their computer. Microsoft is making this easier for Windows users with its eDrive initiative, which allows BitLocker to work with hardware encrypting SSDs built to the later TCG Opal 2.0 and IEEE 1667 standard. Drives like the SSD Pro 2500 here, which is available in a wide range of capacities, namely 120-, 180-, 240-, 360- and 480GB.

Furthering its business credentials, Intel tells us is designed to meet an Annualized [sic] Failure Rate of below 1 percent, and like many modern drives it is covered by a five-year warranty.

The drive can be managed by Intel's SSD Toolbox software for Windows. This allows diagnostic scans, SMART reports and secure erasure, as well as firmware updates. For Linux and OS X users, there are just bootable ISOs for firmware bug fixes.

Performance

In straightforward sequential testing with synthetic benchmarks the Pro 2500 proved to be a fast mover, reaching up to 555MB/s reads in ATTO and 530MB/s write speeds. CrystalDiskMark showed relatively fast results here too in its zero-data mode, just shy of 500MB/s for reads and writes. When the benchmark was set to its default random dataset we saw the usual slowdown experienced by SandForce-based drives, with sequential write speed dropping to 291MB/s.

With the small 4kB random tests the Intel was reading at 31MB/s, a typical result, with writes reaching 70MB/s, which is at the lower end of what's possible with moderns SSDs. When loaded with 32 threads these figures swelled to 302MB/s reads but just 252MB/s writes, where most drive we test tend to exceed 350MB/s.

Looking at input/output operations per second, CDM gave us 77,300 read IOPS and 64,600 write IOPS, while AS SSD reported even lower with 50,100 and 52,900 IOPS respectively. This led to the latter benchmark returning an overall nominal score of 721 points, the lowest on test.

It's worth remembering that the poor benchmark results are a direct result of the SandForce controller and its low write speed when processing incompressible data. This would be most manifest in real-world use if you were working heavily with media files such as JPEG, or even plain ZIP files. For general office tasks this may be less of an issue and the drive should perform at closer to its headline speeds.

VERDICT: The Intel SSD Pro 2500 is designed for Wintel business computing, where its Opal 2.0 compliance may interest IT managers. However this security feature is not unique to business SSDs and can be found on, for example, Crucial and Samsung drives too, at a lower cost. Where the Intel SSD may excel is in its use of older but well-tested components, promoting reliability and freedom from issue inherent with newer hardware and firmware.



KINGSTON HYPERX SAVAGE 480GB

£185 inc VAT • kingston.com/en

Support	★★★☆☆
Performance	★★★★☆
Value	★★★½☆
Overall	★★★½☆

Kingston Memory has been catering for the general user with its SSDNow drives for several years, providing decent performance with entry-level pricing. But the company also knows how to market to PC gamers and computer enthusiasts with its more racily named silicon memory components. We've seen macho names like Ballistix, Predator, Impact and Beast bandied around by Kingston. Now, under the HyperX performance-tuned banner, we have the Savage SSD.

It stands at the top of Kingston's range of performance SATA storage, although if you have a desktop PC you could also take advantage of the full-size PCIe card Predator drive, boasting up to 1400MB/s read speeds. The Savage though takes the traditional SATA Revision 3.0 connection with its nominal 6Gb/s speeds, in the usual slim 7mm enclosure.

What is less usual, even unique in our testing experience, is the choice of controller in the Savage. This is an S10 controller from Taiwan flash-memory specialist Phison, now infamously known as the maker of USB controller ICs that can be compromised by the BadUSB exploit. The controller here is based on a quad-core ARM processor with eight data channels, with 19nm NAND flash supplied by Toshiba.

To maintain its SSDs Kingston makes its own SSD Toolbox software for Windows, although this only supports its older drives based on SandForce controllers. At time of testing there was no software available for this Phison-based SSD.

The HyperX Savage is available as just a bare drive, or an installation kit with various accessories to help migrate from an existing drive. This includes a portable drive enclosure with USB 3.0 with support for UASP mode in Windows 8 and OS X, SATA cable and screws for desktop PCs, and a screwdriver with interchangeable Philips 00 and 1 cross-head tips.

Where many modern SSDs are simple constructions fashioned from lightweight pressed aluminium, the Savage has a heavier case in matt black metal, with a red and silver design covering its top skin.

Performance

It's far from the most important metric of overall performance, but the HyperX Savage returned the joint highest sequential read speed on our PC test rig, reaching 564MB/s, and nudged into the highest write speed, too, of 543MB/s. It's here that we can sense the limiting effect of the SATA interface, nominally 6Gb/s (750MB/s) but in effect around 560MB/s in real-world data transfers.

The similar results from CrystalDiskMark with and without compressible data showed the Phison controller is not using any data-reduction techniques, both tests returning results of around 490MB/s (read) and 480MB/s (write).

At the high 32-thread queue depth, we saw random 4kB reads at 358MB/s and random writes at 370MB/s, translating into good overall IOPS figures of 91,600 and 94,800 IOPS respectively. Turning to AS SSD and its version of the test with 64 threads, the Kingston showed a stronger bias toward read performance as it just nudged the 100,000 IOPS figure, while random writes fell slightly to 83,400 IOPS. The AS SSD benchmark gave this drive an overall nominal score of 1140 points, just behind the leading Samsung 850 PRO drive.

VERDICT: The HyperX Savage turned in a solid performance among the leaders of the pack, and the flashy looks may appeal to those wishing to pimp up their rig. Its overall performance is just behind best from Samsung and SanDisk, and with a price that exceeds these drives, it just loses out on any overall recommendation.



OCZ ARC 100 240GB

£69 inc VAT • ocz.com

Support	★★★★½
Performance	★★★★☆
Value	★★★★½
Overall	★★★★½

PC ADVISOR BEST BUY

The OCZ company appeared early in the history of SSDs as a specialist in performance drives, and still makes high-specification drives under its new owners Toshiba. But the ARC 100 is a value-focused solid-state drive, bringing enough of the virtues of PC flash storage to woo potential disk upgraders, at a most attractive price.

We were sent the 240GB version of the ARC 100 to review, which at the time of writing could be found for just £69. Even in this smaller capacity that represents a price of just 28.8p per gigabyte, making it the best value in this group of six. You can also find the ARC 100 in 120- and 480GB sizes.

Before going bankrupt in 2013, OCZ had a reputation for dying and defective SSDs. However, since Toshiba bought the company in 2014, it has been groomed into a professional, consumer-focused company with an impressive after-sales policy.

OCZ calls this the ShieldPlus warranty, extending for three years for this model. In the event of a fault, there's no need for your receipt, just quote the serial number, and if the support team deem the drive as defective you'll get an advance replacement SSD sent out with free shipping, before you need to return your dud unit.

While most SSDs are using controllers made by Marvell, with SandForce still popular with some brands, OCZ is pressing into service the expertise it bought with the acquisition of Indilinx. Variants of the Indilinx Barefoot 3 are used in all its SATA-based drives, and here it is backed with 512MB of DDR3 DRAM as cache; although OCZ has not revealed this latter specification.

This controller is designed to deliver good sustained performance in long-term use, and does not suffer from slowdowns when presented with incompressible data. For flash-memory silicon, OCZ is using its parent company's toggle NAND with a 19nm process size.

OCZ offers its own software for Windows and Linux with which to update and optimise the drive, SSD Guru. For Mac users there's a bootable ISO for download, which can be written to an optical disc or USB drive.

Performance

We were not expecting the fastest speeds from this budget drive, so were pleasantly surprised by some of the results that placed the ARC 100 ahead of more expensive products. In the simple sequential test, the OCZ did prove to be the slowest, the only drive not to peek above the 500MB/s parapet, although this should be of little concern on daily use. Sequential reads reached 489MB/s and writes 447MB/s.

As promised by OCZ, the Indilinx Barefoot controller does not use any on-the-fly compression tricks to accelerate speed, and CrystalDiskMark reported practically the same speeds for random and compressible data: to wit, 426- and 427MB/s for reads, and 431- and 432MB/s for sequential writes.

Small file performance was very good, with 4kB random reads at 27MB/s – a little lower than most but only by a megabyte or three per second – while 4kB random writes were actually the highest on test at 127MB/s. That's a clean-drive result which will likely drop once the drive reaches steady-state level, but still impressive.

For IOPS the ARC 100 was in good company, approaching 100,000 IOPS for random writes at 90,300 IOPS, and around 80,000 IOPS for random 4kB reads at the same 32 queue depth.

VERDICT: This may be only OCZ's budget drive but it offers great performance with plenty of all-important support to provide peace of mind to anyone concerned about moving to solid-state storage.



SAMSUNG 850 PRO 1TB

£365 inc VAT • samsung.com/uk

Support	★★★★½
Performance	★★★★½
Value	★★★★☆
Overall	★★★★½

PC ADVISOR GOLD

Samsung has two series of SSDs available for computer upgraders, both designated 850 and then divided into 850 PRO and 850 EVO ranges. As may be evident from the naming scheme, the former PRO models are designed for highest performance, while the EVO range trades a little speed and endurance for a lower entry price.

What both have in common is the core silicon architecture that is now based on 3D NAND, or V-NAND, where the V is for vertical. This is the application of three-dimensional integrated circuit construction techniques, which just like human cities overcome the problem of over-crowding by building not sideways, but upwards.

Using 3D lithography, flash cells are built layer by layer on top of each other, 32 layers high here, giving a higher density of storage that means that even for the 1TB sample we tested, for example, the PCB inside only takes up two-thirds of the large 2.5in SATA case.

As with the 840 Series, the difference between PRO and EVO models is the type of flash cell employed; the 850 PRO uses more resilient multi-layer cell (MLC, and in particular the two-bit version) while the 850 EVO takes the latest three-layer cell (TLC), which allows more storage per square centimetre of silicon wafer, but loses out in long-term longevity and is slower to write to.

The 850 PRO is a great example of how Samsung can build an entire SSD with parts it makes itself to its own specification. So we have a Samsung-made MGX Controller chip based on a three-core ARM processor, 1GB of Samsung low-power DDR2 RAM and, of course, the NAND flash piled up to in Samsung's new semiconductor process, still unique in flash memory.

The process size has actually gone up, from the 19- or 20nm common to other brands, up to 40nm, potentially conferring greater longevity while delivering better speed. This has inspired Samsung to offer one of the longest guarantees available, 10 years, matching the offer first made by SanDisk with its Extreme PRO SSD.

Samsung has also been working on the power efficiency issue, and with the help of a special sleep state that can be used by some laptops, publishes a lowest-in-class power consumption figure of just 2mW when in this DEVSLP mode.

Performance

The 850 PRO strolled through our read/write tests, reaching 564MB/s for reads and 534MB/s writes in the ATTO benchmark test. Comparing the CrystalDiskMark results for standard random and compressible zeroes, we see the same level of performance at around 510MB/s sequential reading and 480MB/s writing.

The 4kB single-thread random IO tests place the Samsung ahead in the 4kB random-read list with 36MB/s, while the 89MB/s write speed is impressive, a trend that continued when the SSD was stretched when fielding the high queue-depth test – the 403MB/s random reads and 366MB/s random writes makes the 850 PRO the top of the IOPS with 103,200 read IOPS and 93,700 write IOPS.

When running the comparable test from AS SSD it remained in the over-achievers class with 96,800 read IOPS and 81,400 write IOPS. The AS SSD benchmark awarded the Samsung 850 PRO an overall nominal score of 1145 points, the best overall result in this group.

VERDICT: The 850 PRO arrived just too late for last year's round-up of SSDs, but even a year later it still has little serious competition. It may be left for dust by more modern PCIe drives like Samsung's own XP941, but if you have a SATA-based PC and want to fit it with the best storage, take the closest look at the 850 PRO.



SANDISK EXTREME PRO 480GB

£172 inc VAT • sandisk.co.uk

Support	★★★★½
Performance	★★★★½
Value	★★★★☆
Overall	★★★★½

PC ADVISOR RECOMMENDED

Like Crucial/Micron, Samsung and Toshiba, SanDisk sits at the big table for flash memory dealers. It has a range of SSDs for consumers and business, with the Extreme name reserved for the top solid-state drive for personal computers. The SanDisk Extreme PRO builds on the already excellent Extreme II SSD, adding a larger DRAM cache and revised firmware.

Like the previous Extreme II it replaces, the Extreme PRO relies on the Marvell 88SS9187 controller running SanDisk's own custom firmware. This combination is backed with a generous 1GB of DDR3 memory for the largest 960GB capacity model, and also the 480GB size that we tested.

The main flash chips are again SanDisk's own, the second generation of its 19nm-process NAND. And now sitting between the volatile dynamic RAM cache and the more permanent NAND storage chips is a new version of the non-volatile cache that SanDisk now calls nCache Pro.

SanDisk's nCache Pro is based on fast and resilient single-layer cell (SLC) flash and acts as a halfway house for saving up smaller chunks of data at high speed before consolidating and then flushing them out to the main MLC flash banks.

Three capacities of drive are again offered, only this time they've been moved up in size by a factor of two – so the entry-level SSD is now 240GB rather than 120GB, and a 960GB is the new large. Only the traditional 2.5in SATA form factor is offered at present, in the now-standard 7mm height, so no mSATA or M.2 SATA alternatives.

To maintain and oversee this SanDisk SSD, the company offers its SSD Dashboard program for Windows. We found this to be simple yet well-featured, clearly laid out and able to secure erase, sanitize and TRIM the drive on demand. Firmware updates are easily executed here, too. One feature will not work though, Crypto Erase, since the Extreme PRO does not include any onboard hardware encryption. SSD Dashboard just needs a tick-box setting to switch off in-line advertisements, since we use the program to operate the SSD, not shop for more SanDisk products and those of third parties.

SanDisk stands behind its top consumer SSD by being the first company to offer a 10-year guarantee. Whether there will be many PCs supporting SATA Revision 3.0 drives in another decade is another question.

Performance

The SanDisk Extreme PRO easily clears the low hurdle of high sequential speeds as measured by ATTO Disk Benchmark, with 556MB/s reads and 525MB/s sequential writes. It also pulls off a similar feat with CrystalDiskMark, which is usually a tougher judge here, with 511MB/s reads and 478MB/s writes; mirrored closely in speed when using random data here, too.

When presented with 4kB single-threaded datastreams it kept up the pace, just behind the Samsung with 32MB/s 4kB random reads and 88MB/s random writes. As the queue depth increased to 32 threads the SanDisk remained unfazed, ending in a read IOPS figure just shy of the nominal watershed of 100,000 IOPS, and write performance at around 79k IOPS.

VERDICT: SanDisk's top consumer SSD is backed by a confident 10-year guarantee, and its clear high performance a great value at around 36 pence per gigabyte make this one of the top SSDs you can find today, even a year after its launch.



Conclusion

In the earlier days of solid-state upgrade drives, Intel was one of the prime movers, but the silicon specialist seems to have lost its interest and early lead, and now recycles other company's components. The Pro 2500 Series is based on a reliable platform, using an old but still reliable SandForce controller, adding hardware encryption as a near-necessity for a drive that otherwise would be slowed too much due by its compression dependency in a solely software-encrypted OS. The result is the rather poor value Pro 2500, which nevertheless was found to perform confidently well in most areas, and is backed by a five-year guarantee.

Kingston's performance-inclined HyperX Savage continues the company's marketing theme of brash colours and brasher names, but there is a little less substance below this gamer-friendly styling. We would be less concerned about the relatively poor 4kB random read/write figures, for instance, if this drive wasn't the most expensive on test after the Intel. Its support is also lacking somewhat, both in availability of software and in length of warranty.

Crucial's SSDs have been a favourite for PC upgraders, although with the MX200 we can't help feeling the real benefactor in this season's upgrade is Crucial alone. The drive performs little better and in our tests typically just behind the previous M550 model. Its construction quality is visibly cheapened and the flash stock has shrunken, both moves to maximise corporation profits. In its favour the Crucial MX200 is good value in price-per-gigabyte terms and the brand's SSDs are ably supported with firmware and tools to apply it on any platform.

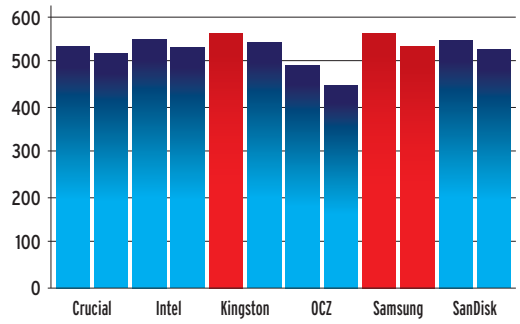
The erstwhile enthusiast brand of OCZ has a surprising cracker in its portfolio with the ARC 100, which is not only one of the best value drives we've seen, it also turned in some great performance results.

The two leading SATA SSDs of today are both a year old, but have not been surpassed by anything in the same category since. The SanDisk Extreme PRO was the first SSD to receive a 10-year guarantee, which should give any user the confidence to go solid-state; the Samsung 850 PRO launched a few weeks later in June last year and was also upgraded to a 10-year support scheme.

Both offer state-of-the-art performance on a SATA connection, and can be found for around 36p/GB, depending on capacity. We highly recommend the SanDisk drive, and award the Samsung our Gold Award for its breakthrough in 3D semiconductor manufacture, which combined with the larger 40nm process should ensure this drive is going fast and going strong even after the decade counter rolls over.

	CRUCIAL £301 inc VAT (£250 ex VAT) ★★★½☆	INTEL £126 inc VAT (£105 ex VAT) ★★★½☆	KINGSTON £185 inc VAT (£154 ex VAT) ★★★½☆
Product name	MX200	SSD Pro 2500	HyperX Savage
Capacity tested	1TB	240GB	480GB
Price per gigabyte	30.1p	52.5p	38.5p
Other capacities	250-, 500GB	120-, 180-, 360-, 480GB	120-, 240-, 960GB
Memory cache	1GB DDR3	Unknown	256MB
Controller	Marvell 88SS9189	SandForce SF-2281	Phison PS3110 S10
Flash	16nm Micron MLC	20nm SK Hynix MLC	19nm Toshiba A19 MLC
Firmware update support	Crucial Storage Executive; bootable ISO for Linux/OS X	Intel SSD Toolbox for Windows; firmware update tool for OS X/Linux	None
Warranty	3 years	5 years	3 years
Weight	53g	62g	99g
PERFORMANCE			
ATTO (peak sequential)	533-/514MB/s	555-/530MB/s	564-/543MB/s
CrystalDiskMark (Seq 0x00)	413-/466MB/s	499-/495MB/s	494-/479MB/s
CrystalDiskMark (Seq rnd)	438-/480MB/s	485-/291MB/s	489-/478MB/s
CrystalDiskMark (4kB rnd)	29-/131MB/s	31-/70MB/s	26-/59MB/s
CrystalDiskMark (4kB QD32 rnd)	102-/352MB/s	302-/252MB/s	358-/370MB/s
AS SSD (IOPS)	67,700/79,100	50,100/52,900	100,000/83,400

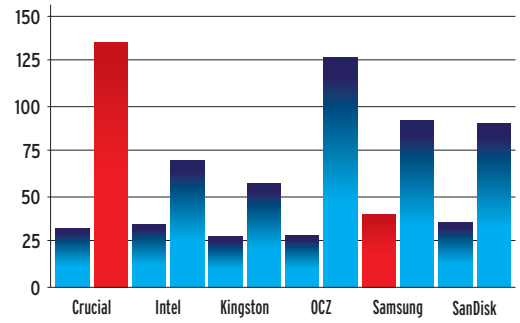
ATTO peak sequential (read/write, MB/s)



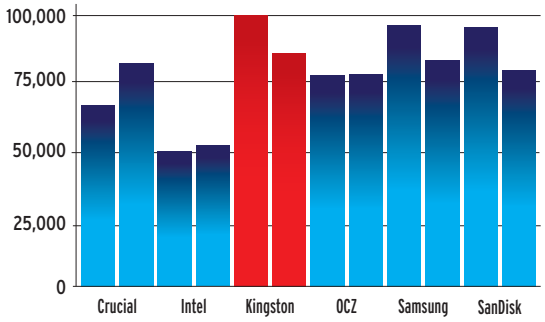
How we test

We assessed most aspects of a drive's performance with industry-standard benchmark tests for Windows, namely ATTO Disk Benchmark, HD Tune Pro, HD Tach, CrystalDiskMark and AS SSD. Measured speeds for storage products are typically in megabytes per second (MB/s) for large files; and input/output operations per second (IOPS) for paralleled small-file transfers.

CrystalDiskMark 4kB rnd (read/write, MB/s)



ASS SD (IOPs)



	OCZ £69 inc VAT (£57 ex VAT) PC ADVISOR BEST BUY	SAMSUNG £365 inc VAT (£304 ex VAT) PC ADVISOR GOLD	SANDISK £172 inc VAT (£143 ex VAT) PC ADVISOR RECOMMENDED
	Arc 100	850 PRO	SSD PRO 2500
	240GB	1TB	480GB
	28.8p	36.5p	35.8p
	120-, 480GB	256-, 512GB	240-, 960GB
	512MB DDR3	1GB LPDDR2	1GB
	Indilinx Barefoot 3 M10	Samsung MCX	Marvell 88SS9187
	19nm Toshiba A19 MLC	40nm Samsung V-NAND MLC	19nm SanDisk MLC
	OCZ SSD Guru for Linux and Windows; bootable ISO for OS X	Samsung SSD Magician for Windows; bootable ISO for OS X and Linux	SanDisk SSD Dashboard for Windows; bootable ISO for Linux and OS X
	3 years	10 years	10 years
	104g	52g	58g
	489-/447MB/s	564-/534MB/s	556-/525MB/s
	426-/431MB/s	515-/481MB/s	511-/478MB/s
	427-/432MB/s	508-/482MB/s	513-/490MB/s
	27-/127MB/s	36-/89MB/s	32-/88MB/s
	309-/340MB/s	403-/366MB/s	401-/357MB/s
	76,600/77,000	96,800/81,400	96,400/78,600



Photography by Dominik Tomaszewski

These days being able to take decent photos is a must for smartphones. With this in mind, Jim Martin has put nine flagship models through their paces to find out which performs best for photos, videos, selfies, macro and in low light

For many people, a phone's cameras are one of the biggest priorities when choosing a new handset. Since you carry your phone everywhere, you're more likely to use it to take photos than a separate camera. Thanks to the fact that phones have become rather talented at taking photos and videos, they might even be better quality than your current camera.

There are, of course, a few downsides, one of which is that you won't get a zoom lens for getting in close when you can't physically move. Even the best phone cameras struggle to match the quality of even a budget DSLR lens because they're so small, and you'll only be able to get blurred backgrounds using software effects.

However, phones have their own special effects. They vary from model to model, but you can expect to find burst shooting, slo-mo video, time-lapse, automatic selfie capture when you smile or say "cheese", and even light painting on the new Huawei P8.

We've gathered together as many of the latest flagships as we could lay our hands on, including the Samsung Galaxy S6, LG G4, Huawei P8 and both of the current iPhones, so you can see how their cameras perform in good light outdoors, poor light indoors, in close-ups, for video and also for selfies using the front camera.

Around half of the phones here can shoot video at 4K, though you'll need a 4K monitor to view the video clips at their full detail. However, you'll still benefit from the extra resolution even on a 1080p screen, but beware that you need a fairly powerful laptop or PC to play back 4K video smoothly.

Note that the Xperia Z3 and Z3 Compact share the same front and rear cameras, so you can use the photo examples here to judge both phones.



CAMERA SPECIFICATIONS

	MAIN CAMERA RESOLUTION	FRONT CAMERA RESOLUTION	VIDEO (MAX. RESOLUTION)	OPTICAL STABILISATION (OIS)	FLASH	DEDICATED CAMERA BUTTON
iPhone 6	8Mp	1.2Mp	1080p at 60fps	No	Dual-tone LED	No
iPhone 6 Plus	8Mp	1.2Mp	1080p at 60fps	Yes	Dual-tone LED	No
Google Nexus 6	13Mp	2Mp	2160p at 30fps	No	Dual-LED ring	No
HTC One M9	20Mp	4Mp	2160p at 30fps	No	Dual-tone LED	No
Huawei P8	13Mp	8Mp	1080p at 30fps	No	Dual-LED	No
LG G4	16Mp	8Mp	2160p at 30fps	Yes	LED	No
Nokia Lumia 930	20Mp	1.2Mp	2160p at 30fps	Yes	Dual-LED	Yes
Samsung Galaxy S6	16Mp	5Mp	2160p at 30fps	Yes	LED	No
Sony Xperia Z3 Compact	20.7Mp	2.2Mp	2160p at 30fps	No	LED	Yes

OUTDOOR PHOTO



Apple iPhone 6

Most phone cameras excel in bright conditions and low contrast, so it's no surprise to see the iPhone 6 performing well here. We also like the aspect ratio and wide-angle lens.



Apple iPhone 6 Plus

There's little to choose between the two iPhones here.



Google Nexus 6

The Nexus 6's white balance is a bit off, leading to a cooler-looking photo compared to the warm iPhones. Where it shines is the high-resolution sensor which captures lots of sharp detail, and the lens is sharp to the edges.



HTC One M9

Worse than the Nexus 6's auto white balance is the One M9's. It has also blown out the highlights in the clouds. Aside from this, though, it's a nice sharp image with lots of detail.



Nokia Lumia 930

As with the 930's other photos, this one exhibits slight underexposure and a bit too much contrast - made obvious when you compare it to the Galaxy S6. The white balance isn't right either.



Huawei P8

This is a well-exposed image with reasonably accurate colours. The wide field of view means it captures more than most phones, too. Plus, there's very little evidence of compression artifacts with plenty of detail in the brickwork of St Pancras hotel.



Samsung Galaxy S6

If we had to pick a winner for the St Pancras photo, this would be it. Despite having a 16:9 sensor, the wide-angle lens means more of the scene is captured than the LG G4, and there's more sharp detail throughout the photo. White balance is also spot on.



LG G4

Exposure and white balance are good, and we marvelled at the level of detail in the 16Mp image when zooming to 100 per cent. We'd prefer something other than a 16:9 sensor, but there's enough resolution to crop off the sides and still end up with plenty of detail.



Sony Xperia Z3 Compact

A slightly cool white balance, but the Z3 Compact does a good job in bright light. The image is well exposed and nice and sharp. At 100 percent there's evidence of compression, but most people will be happy with the Z3's performance.

OUTDOOR PHOTO



iPhone 6

One of the iPhone's strengths is that colour accuracy is always excellent. There's a lack of detail when you zoom in due to the low-resolution sensor, but they're fine for printing out or sharing online.



Apple iPhone 6 Plus

The 6 Plus excels in good light, with sharp detail and fantastic colour accuracy. The default camera app also has an automatic HDR mode, which increases the dynamic range for high-contrast scenes.



Google Nexus 6

It doesn't have the bright greens of the iPhone photos, but the Nexus 6 does a decent job here. Highlights are clipped, but it's far from the worst photo in this group.



HTC One M9

On its own, you'd be hard pushed to criticise the One M9's park photo. It's well exposed and only when you zoom in do you notice the slightly soft focus. But again, there's a colour cast that turns the path here almost beige when it should be grey.



Nokia Lumia 930

The 930 appears to have a limited dynamic range given that the sky is blown out, yet the trees appear as if the photo was taken when the sun went in. But as you can see from the shadows on the path, conditions were the same for the other cameras.



Huawei P8

In attempting to avoid losing detail in darker areas, the P8 has over exposed this photo and the clouds are blown out and lack detail. White balance and detail are both good though.



Samsung Galaxy S6

Once again, the S6 flexes its photographic muscles and delivers a stunning photo with great colours, lots of sharp detail and good dynamic range. Yes, the clouds are blown out, but no phone's camera here can do better without using its HDR mode.



LG G4

The G4 has also blown out the clouds, but as with the Huawei P8, it's still a pleasing photo with accurate colours. At 100 percent, details are a little sharper than the P8's, too.



Sony Xperia Z3 Compact

The Z3 again shows that it can't keep up with the best here. The photo is fractionally overexposed and white balance is on the cool side. Detail levels and sharpness are impressive, though.

MACRO PHOTO



Apple iPhone 6

It doesn't have the best macro capabilities of our group of phones here, but the iPhone 6 can easily hold its own. Details are sharp and – just as importantly – colours are wonderful.



Apple iPhone 6 Plus

Once more, it's virtually a carbon copy of the iPhone 6, and we're more than happy with the iPhone 6's macro photo



Google Nexus 6

The Nexus 6's macro photo shows poor white balance, but it's able to focus slightly closer than the iPhones.



HTC One M9

Not a bad photo at all from the HTC, although it isn't the sharpest photo in the group.



Nokia Lumia 930

The Nokia 930 can't focus as close as the rest of the group, but its macro photo is sharp and well exposed.



Huawei P8

The P8 almost managed to focus as close as the LG G4, but it's hard to tell when it's in focus using the stock camera app. Highlights on the petals are clipped, too.



Samsung Galaxy S6

It can't match the LG here, but the Galaxy S6 yet again proves it can capture sharp detail and sumptuous colours.



LG G4

The G4 impressed us with its macro abilities: focus is crisp and the delicate pink petals are perfectly exposed.



Sony Xperia Z3 Compact

White balance is a problem for the Z3, and it can't focus particularly close either. Detail levels aren't as good as the Samsung or LG either.

LOW-LIGHT PHOTO



Apple iPhone 6

Low light is one of the areas where you can clearly see the difference in the capabilities of the two iPhones' cameras. It isn't as obvious unless you zoom in and look at the images at 100 percent, but suffice to say that the 6 simply isn't as good as the 6 Plus.



Apple iPhone 6 Plus

Aside from the muted colours, this is a good result. There's very little noise – far less than the LG G4 – but the photo isn't as sharp.



Google Nexus 6

You might think we haven't tried hard enough with the Nexus 6, but no matter what we did, we couldn't get a sharp photo in these lighting conditions. It does a good job of suppressing noise, though.



HTC One M9

The M9 doesn't embarrass itself in low light thanks to great colour reproduction. However, zoom in and you'll see details are smeary, which appears to be due to over-enthusiastic noise reduction.



Nokia Lumia 930

Once again a little underexposed, but the 930 is eminently capable in low light. Details are sharp and there's hardly any noise.



Huawei P8

Not a great show from the P8 again. Colours are undersaturated and there's evidence of heavy-handed noise reduction when you zoom in, meaning detail levels are reduced.



Samsung Galaxy S6

A little soft, but overall a respectable result from the Samsung. Colours are good and there's very little noise.



LG G4

The G4 almost aces this test, delivering a sharp photo with amazing colours. The only niggle is noise, which is evident when you zoom in, but it's much harder to see when looking at the overall photo. A fantastic effort here.



Sony Xperia Z3 Compact

The Z3 Compact isn't great in low light. The colours are a bit undersaturated, but the biggest issue that focus is very soft and therefore there's a distinct lack of sharp detail.

SELFIE



Apple iPhone 6

In selfie land, the iPhones show their weakness: the low-resolution 1.2Mp camera. Although well exposed, there's a distinct lack of detail.



Apple iPhone 6 Plus

As you'd expect, you get the same result with the iPhone 6 Plus as it has an identical front camera.



Google Nexus 6

A pretty good result from the Nexus 6's front camera, with good skin tones and detail.



Huawei P8

An overly sharp shot from the P8, with unflattering skin tones.



HTC One M9

The One M9's selfie is pretty good, with warm skin tones and enough sharp detail without bringing out skin textures (wrinkles, pimples, freckles) you might rather stay hidden.



LG G4

Oddly the G4 defaults to a mirrored mode, which is why this photo is flipped vertically. Skin tones are excellent.

SELFIE (CONTINUED)



Samsung Galaxy S6

This was taken with the S6's Beauty mode at level 2 (fairly low), but it still smooths out detail too much for our liking. The S6 has a very capable front camera, however.



Nokia Lumia 930

Another underexposed photo from the Lumia 930. Skin tones are good, but the 1.2Mp resolution means there's not much detail.



Sony Xperia Z3 Compact

A dismal, ghostly effort from the Z3 here.

VIDEO

Apple iPhone 6
Considering it has no optical stabilisation and is limited to 1080p, the iPhone 6's footage is very good. It has a good level of detail, but more importantly it doesn't struggle to focus thanks to its magical Focus Pixels and has natural-looking colours

Apple iPhone 6 Plus
No surprise that the 6 Plus's footage is virtually identical to the 6's. The advantage is that it has optical stabilisation, which gives a more cinematic feel, just as Apple claims.

Google Nexus 6
Like all phones capable of shooting 4K video, the Nexus 6 captures a lot of detail considering how highly it compresses footage. While exposure and colour accuracy are good, it was annoying that the camera kept refocusing even though we weren't moving the phone.

HTC One M9
This was the most disappointing 4K footage. Not only does the HTC One M9 lack stabilisation, which led to shaky video – don't forget this will be magnified on a large TV – but it also showed up poor white balance with a strange magenta cast.

Huawei P8
The P8's video is much poorer than we'd expected. It's limited to 1080p but even so, there's much less detail than the iPhone 6 and 6 Plus capture.

LG G4
The best on test for video, capturing loads of sharp detail and overcoming shaky hands thanks to great stabilisation.

Nokia Lumia 930
Our 930 didn't have the Denim update, so was limited to shooting at 1080p. It can capture 4K at 30fps with the update, though. Even so, the 1080p footage was mediocre at best. There was a surprising lack of detail and colours weren't as natural as we'd like.

Samsung Galaxy S6
The Samsung Galaxy S6 comes in a close second to the G4 here. Its 4K video looks great on a large TV, with realistic, life-like colours and good stabilisation.

Sony Xperia Z3 Compact
The Z3 Compact's 4K footage is also detailed but the lack of stabilisation lets it down.



See *PC Advisor* online to watch the videos:
tinyurl.com/opq2ghj

VERDICT

There are two clear winners here: the LG G4 and Samsung Galaxy S6. Both take excellent photos and videos, and are also great phones. If you want us to declare only one winner, then the G4 narrowly pips the S6 to the post by virtue of its excellent three-axis stabilisation.

There's a lot more to consider than just photo and video quality when picking the best phone camera, of course. The screen resolution and brightness play a part, as does the camera app itself, which determines the features and settings on offer.

Only two phones here have dedicated shutter buttons: the Sony Xperia Z3 Compact and Nokia Lumia 930. However, neither can challenge the best cameras here, so it isn't a reason to choose them instead.

Naturally, you shouldn't only consider the camera when buying a phone: the operating system, screen size, battery life and price will also be factors.

We can't tell you which phone is best for you, but hopefully these comparisons have proved helpful in making your choice.

HOW WE TESTED

To make this comparison fair, we set up each phone to the highest resolution available for photos and videos. We also took each shot within a minute or so of each other to ensure lighting conditions were as similar as possible.

All photos and videos were taken handheld, rather than on a tripod because that's how you'll use the phone in real life. It also allowed stabilisation systems to prove their worth, and we ensured they were all turned on where present. We selected automatic modes and didn't tap the screen to choose focus or exposure since none of our test shots was designed to trick the cameras: they should all perform well with automatic exposure. Again, most people will rely on auto mode to capture the moment.

As you can see in our shot of St Pancras, the field of view varies between phones. These were all taken from precisely the same spot, so it's easy to see which have 16:9 and which have 4:3 sensors. In each case, we made sure we used the highest resolution available – many Android phones default to 16:9, which chops the top and bottom off the photo for phones with 4:3 sensors. (Note, we made a mistake with the HTC One M9, shooting at 16:9 instead of 10:7 because it isn't obvious which is the highest resolution. Rather than reshooting later in different light conditions, we decided to use the cropped images instead)

One of the most interesting observations during the test was how much the experience of taking photos and videos differed with each phone. For example, the Samsung Galaxy S6's bright AMOLED screen made it easy to frame photos in sunny conditions.

The LG G4's screen wasn't as easy to see, but the extra resolution meant it was easy to see whether a macro photo would be blurry or not before taking the shot. By contrast, the Z3 Compact's 720p screen made it impossible as the detail simply wasn't there.

All the photos in this group test can be viewed on the *PC Advisor* website at tinyurl.com/opq2ghj.



iOS 9 vs Android M

With new versions of iOS and Android due this autumn, we've decided to compare the two. Matt Egan reports

In June, Apple announced iOS 9, the next-generation of its iPhone and iPad operating system. It will go head-to-head with Google's Android M at the top of the Android phones and tablets market, so we decided to compare and contrast the two leading mobile platforms.

Release date

We now know definitively that both iOS 9 and Android M are in the works. What we don't know is when exactly they will launch. But we can make some good guesses: iOS 9 will launch in 'Fall 2015', according to Apple. It wasn't specific because it doesn't want to give away the date of the next iPhone and iPad launches, which will likely be the same day. But expect a new OS in September 2015.

Meanwhile, at I/O 2015 Google unveiled an Android M Developer Preview, confirming the existence of the next flagship Android OS. The final version of Android M will launch with a new Nexus phone in October or November this year. But unlike iOS, we won't then see a rapid roll out to all compatible devices: Android M will appear first on other Nexus devices, and within a few months make the move to flagship phones and tablets made by third-party OEMs such as Samsung, LG and Sony. Unless you are a Nexus guy, don't expect to get Android M on your device until late 2015 or even early 2016.

Betas

For the first time I can remember, Apple is running a public beta of its iOS update. You can try out the iOS 9 beta in a few months, but you can sign up now by signing up at beta.apple.com. Developers can download the first beta of iOS 9 immediately, though.

Similarly, if you want to get your hands on Android M now, you can download the Android M Developer Preview, but only if you have a Nexus 5, 6, 9 or Player. As with the iPhone equivalent, it should be said that developer preview software is really only for, er, developers. Expect bugs and frequent updates, as well as missing features.

As with the iPhone equivalent, it should be said that developer preview software is really only for, er, developers. Expect bugs and frequent updates, as well as missing features

Compatibility

This is one of the fundamental differences between iOS and Android. Because Apple makes both software and hardware, it rolls out its new software in a quick and efficient manner. Thus every iPhone and iPad that now runs iOS 8 will be able to upgrade to iOS 9, the day it comes out. And unlike previous iOS updates, Apple promises that this time around, the update file won't be as big as your iPhone's available storage. Older iPhones won't all get some features, though. (If your phone doesn't have an NFC chip, you won't be able to use Apple Pay, for instance.)

Android M's compatibility will be more scattered. Because Google can make the software available to its OEM partners, but they are not forced to push the upgrade out to end users. So while Nexus devices are pretty much guaranteed an over the air (OTA) upgrade to Android M, those with phones made by other people have no guarantee. However, if you have a flagship phone from 2014 or 2015, it is most unlikely you won't get the upgrade at some point.

Apple Pay vs Android Pay

Both iOS 9 and Android M share one major new feature: NFC-enabled contactless payments. With Apple Pay and Android Pay, you will be able to use your phone like a

contactless credit or debit card. (Your wallet will now have a battery life, but at least you have to carry only one device.)

Apple Pay is first out of the blocks. At the time of writing, it was due to hit the UK on 14 July, with support from eight major banks and retailers such as Costa, Boots, Waitrose and the London Underground. Apple Pay first launched in the US on 20 October 2014 and now it is coming here. This despite a new set of regulations from the European Union Council of Ministers that some thought could throw a spanner in the works. (These tighter regulations could require additional authorisation processes.)

Despite this, Apple said that 70 percent of credit- and debit cards in the UK will be supported by Apple Pay at launch. At WWDC 2015, it showed a graphic which name-checked all the major high street banks, with the exception of Barclays. In terms of retailers, the original list includes McDonalds, Lidl, Marks & Spencer, Boots, Waitrose and Costa Coffee.

This is very much a score for Apple Pay, as there is no news as yet as to when Android Pay will make it to the UK. At present all Google has said is that the service will be launching in the next few months, though this will apply to the US rather, with the UK to follow some time later.

At the Google I/O presentation in which Android Pay was announced all of the companies listed as partners – either banks, shops, or mobile phone carriers – were US-based, and there was no mention of a UK or European version. It will happen, but it will take a while. So if contactless payments is your thing, the iPhone is the device for you.

New features

Let's take a look at some of the other new features that may tempt you into the arms of either iOS 9 or Android M. Key features of iOS 9 include a major Siri update and deep-links in search results.

Apple says it has made Siri more proactive. The new features are intended to give iPhone users the same sort of functionality as Android owners already have in Google Now. And this new proactivity isn't only part of Siri but also of search. Spotlight search will display information such as imminent events from the Calendar app, locations nearby that might interest you, boarding passes for flights you'll be boarding that day and more.

Split-screen multitasking is part of iOS 9, too and there's a picture-in-picture mode that allows you to watch videos while you do other things, though these features are iPad only.

As we will see when we discuss Android M features, lots of Apple's competitors offer software-based battery-saving modes for their devices, and Apple will do the same when it launches iOS 9. Apple says its feature should provide up to three hours of extra use, on top of the extra hour or so you'll get simply from updating to iOS 9, which is more power efficient than iOS 8 (Apple says).

Turning to Android M and we find something similar in what Google calls 'Doze mode'. Doze monitors when the device isn't being used to put it into a deep sleep, which uses less power and can double your battery life – according to Google.

The SystemUI Tuner in Android M allows you to customise the Quick Settings to the ones you want to you the most and in the layout which suits you. Another small but handy change is the ability to uninstall apps straight from the home screen. You now get the choice between simply removing the shortcut/icon or actually uninstalling the app from the device entirely.

Google Now is a great feature of Android and it gets even better in Android M. Now on Tap means you can long press the home button wherever you are you call up Google Now. Better still, you don't need to navigate away from the app you're using and it will already have a good idea of what help you need based on what you've been doing, such as Directions to a specific location after chatting to a friend about meeting up.

We've already got fingerprint scanners on numerous devices so it might not seem like a new feature, but Android M natively supports them. This means you'll be able to use them to authorise payments via Android Pay and confirm Play store purchases. Developers can also use the functionality within their apps.

One annoying thing about Android is that downloading an app requires you to agree to all its permissions, which might include things you don't agree with, such as access to your contacts when it's an endless runner game. Well Android M is going to change that with the ability to pick and choose which permissions you're happy with for each individual app. You'll also be able to accept or deny a specific permission as and when an app requests it.

If you send links, photos or files to the same contacts, then Android M will start adding them to the Share menu to speed up the process. It's a bit like having favourite contacts when you open the Dialler app to call someone.

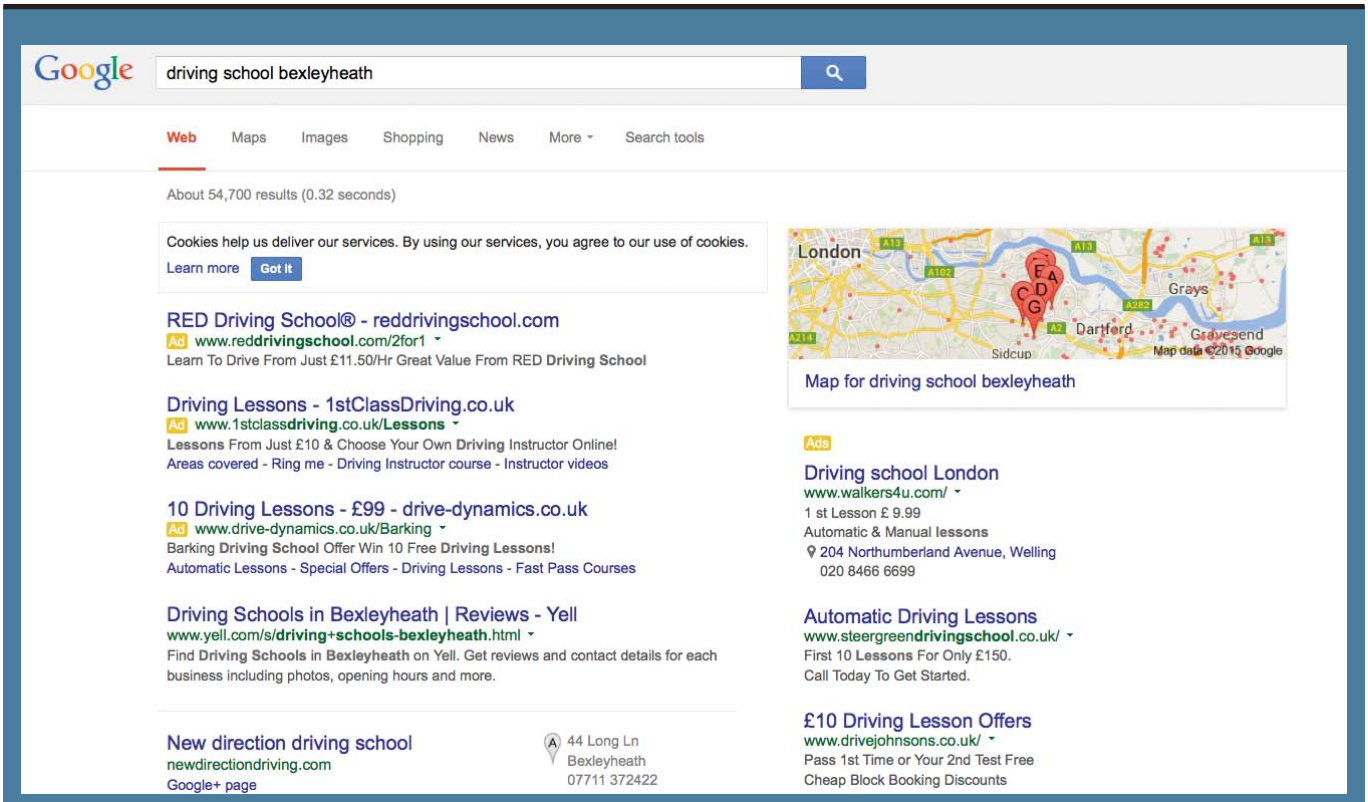
Not only is Do Not Disturb (DND) part of Quick Settings in Android M, the volume control has been tweaked for the better. You can now easily control the volume of calls, notifications and alarms with three separate sliders – simple but effective.

Okay, it's a hardware feature but Android M supports USB Type C, which is good news for future devices – potentially starting with the Nexus 5 2015. You can plug it in either way around, it will charge your device quicker and even allow you to charge other devices.

Verdict

It is too early to make a definitive judgment, but the old truths are likely to remain. If you want ultimate polish, and are prepared to sacrifice your freedom to shop for apps and media outside of Apple's walls, then iOS 9 is for you. It is a prison, but a beautiful, comfortable one. Meanwhile on the Android side of the house the days when Google's platform was hard to use are long gone. But it is probably still fair to say that iOS is a marginally more shallow learning curve for beginners. If you asked me to choose, I would plump for Android, but it really is a personal choice. And Apple Pay being available is a big win for iOS 9. Let's see what the autumn brings. ☒





Boost the online presence of your business

Jim Martin explains how to get your business listed in both Google and online business directories

Search engines

First up, this isn't an article explaining every last detail about search engine optimisation (SEO). There are entire books on the subject, and it is well worth reading up on SEO to more fully understand it. Here, we'll explain the basic principles of how to ensure your website gets found by more customers.

Most search engines will automatically pick up your site, so there's no need to manually add it using their online forms. But if you want to be listed at the top of the search rankings, it's most important to ensure that your site meets the current requirements. For example, Google recently started penalising sites that don't work properly on mobile devices. So if you haven't checked how your site looks on a phone, you should.

If it doesn't work, you'll need to put things right. The website builder tools included with most hosting packages should be up to date and will make your site compatible with all screen sizes, but if yours doesn't it could be time to change hosting providers or change the settings in your provider's online dashboard.

Yet another important factor is having lots of links to your site from other websites. If there are none, you may have to submit your site to Google manually.

Local searches

For some types of business, attracting local custom is your top priority. There's little point in a London-based driving instructor being found by someone searching for driving lessons in Edinburgh. That's where business directories come in, as well as Google's local listings. You can submit or correct details held about your business by going to google.co.uk/business. When you profile on Google is complete your business will show up on Google Maps as well as in search results.

It's also good to get listed on the big directories including Thomson Local and Yell. Both sites offer free listings – tinyurl.com/q2zf5o7 and tinyurl.com/ob2edan, respectively. However, you can pay for a more prominent listing in Yell's listings. The cost will depend on the prominence you want and the local areas you want to reach. It's possible to haggle on price, so you may be able to save on the figure you're quoted online.

One way to ensure your listing is always up to date across multiple directories is 1&1's List Local service (tinyurl.com/qgvnejx). The basic £9.99 per month package doesn't include Thomsonlocal and the Pro version isn't cheap at £29.99 per month. You'll also need the Pro package if you have more than one business location.

Your website

Given that many small businesses have no website at all, it's worth having even a basic site with your contact information, a photo of your office, unit or shop front, opening hours and any other relevant details. It isn't hard to produce a modern-looking site using the site-building tools we mentioned earlier. Some, including 1&1 MyWebsite 8 (tinyurl.com/ph3y3tj), will even pre-fill a lot of the text for you, so it won't take long to make it specific to your business.

Even more important than the site looking good is to make sure you give each page a title that describes the page properly. This will help to improve your Google ranking. Look for an option or setting somewhere in your site builder dashboard for title and meta descriptions: this is the information which will be shown in Google listings, which is why the description is also important. ☒



Duplicate a screen on multiple monitors

Jim Martin shows how to duplicate a computer's screen, so that it can be seen on different monitors

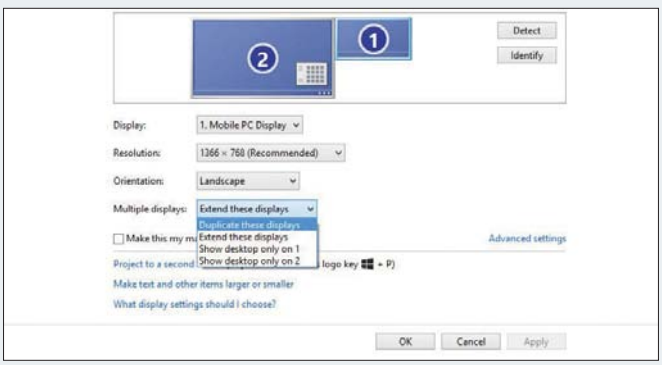
Windows makes it surprisingly easy to work with multiple monitors, but in most cases you'll be working with two, or perhaps three at a push. Two is great for having several applications visible at once, while three is great for gaming – if your graphics card is up to the job. Here we're using Windows 8.1, but the process is almost identical in Windows 7.

Duplicate screen on multiple monitors

When you first connect a second monitor, Windows should detect it and automatically duplicate the screen on both displays. This is the case regardless of whether you have a PC with two monitors or a laptop with a screen or projector attached.

If you don't see an image on the second screen, look for a function key on the top row of keys on your laptop which shows two monitors. Press the Fn key and the appropriate function key (F5 on the laptop below, for example) and it should toggle through the various configurations: laptop display only, laptop and external screen, and external screen only. You can also try pressing the Windows key and P at the same time for the same effect.

If you still have no image, go to the Windows desktop, right-click and choose screen resolution. If you see only one screen in the drop-down Display list, try clicking the Detect button to force Windows to scan for the second screen. If it has detected it, you can use the other options in this window to choose how Windows deals with multiple monitors.

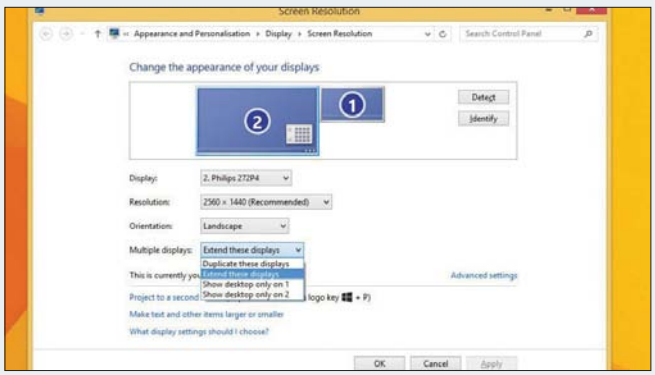


Since you want to duplicate the screens and have the same image on both, make sure 'Duplicate these displays' is selected in the Multiple displays drop-down menu (see bottom-left image).

Note that duplicating displays is often a compromise if the screens have different resolutions or aspect ratios. For example, if you hook up a 1024x768 projector to a laptop with a 1366x768 screen, both will run at 1024x768, and you'll end up with black bars on the left and right on your laptop screen.

Extend the desktop across multiple monitors

Assuming you're not using a projector, which is when it makes sense to duplicate the screen, then you probably want to extend the desktop to have different things on each screen. To do that, choose 'Extend these displays' instead of 'Duplicate these displays'.



You can select a monitor in the diagram at the top and drag it to the position it's in on your desk. Here we've put the second monitor on the left of the laptop because it defaults to the right. You can move the smaller screen up and down, too.

You'll also notice you can select different resolutions for each screen, but you have to select each screen in turn. Only one of the monitors can be your main display. In Windows 7, that means it will be the only monitor with a task bar and start button. In Windows 8.1, you get those on all screens, but only the notification area and clock on the main screen. ☒



Get all the bandwidth on a shared network

Martyn Casserly reveals how you can improve the speed of your web connection on a shared network

Using applications such as Skype, Netflix, YouTube or online gaming requires a fast internet connection to run smoothly. This can be hard to maintain if you share your connection with family or flatmates who also want to download large files, stream music or watch iPlayer. Here we'll show you how to get all, or at least a premium slice, of the bandwidth on a shared network.

Ask others to stop using the internet

Before you delve into the technical solutions for these problems, you could always talk to the people you live with. If you want to call someone on Skype, but find that the video keeps freezing because Tom in the next room is mainlining the new series of *House of Cards*, you can always arrange beforehand to have the connection free for a while.

Of course, this works both ways, so you'll have to stay offline at some point to return the favour. Do consider the fact that the connection is shared, so expecting others to keep off the internet every night just so that your ping rate on Call of Duty stays as low as possible won't make you a good flatmate.

Switch from Wi-Fi to ethernet

One way to improve the consistency of your connection is to plug directly into the router. Wi-Fi may well give you freedom, but an ethernet cable gives you stability and avoids the various obstacles, such as walls, which can hamper your Wi-Fi experience. To get technical, ethernet is full duplex, but Wi-Fi is only half-duplex. In essence Wi-Fi is much slower than ethernet.

Ideally, you would connect your PC or laptop via an ethernet cable into your router, looking to see if there is a Gigabit port marked on the unit. It's only worth looking for a Gigabit port if your laptop or PC has a Gigabit network adaptor of course.

This tip won't give you priority over other users, but will eliminate random elements in your house that could cause you to have a reduced service. Quite obviously, it's not relevant for smartphones or tablets without ethernet ports.

Use Powerline devices to extend the range of the network

Routers aren't always positioned in convenient places, and really should be in the centre of the house to provide the best coverage for everyone. So if you can't plug directly into the router itself, you could always use powerline adaptors, which use the mains wiring in your home to communicate.

The principle is simple, you buy a couple of powerline devices (pictured right), plug one into the wall socket nearest the router and the other in the socket nearest your computer, then connect each adaptor to the router or PC with an ethernet cable. Now it's like you're plugging directly into the router, even though you might be on the other side of the house.

Tweak your router settings for quality of service, prioritisation, and dual-band

It's a sad truth that most of us will spend many hundreds of pounds, thousands even, on our electronic equipment and then

connect to the internet via the free router that was given to us by our ISP (or was already in the house). Don't get us wrong, some are very good, but often these devices are old technology and certainly not top of the line. Getting the optimum performance out of them is essential then, and can be done with a few tweaks.

First, you'll need to ascertain the various capabilities of your service and equipment. To check your connection speed open a browser and go to speedtest.com. Here you'll be able to run a simple test that will show you how fast your net connection is. A recent report stated that the average speed for home broadband in the UK was a little over 10Mb, so if you find you're in that bracket you should be able to use video, gaming and streaming services without too many issues. If you're below 5Mb, then it might be worth seeing if there are any services, such as BT Infinity or Virgin Media, that are offered in your area as there isn't much that a router can do if the supply it receives is slow.

Dual-band settings

Ideally, you'll want to have a dual-band router, as these allow you to allocate different devices or applications to different bandwidth. For example, 802.11n can run on 2.4GHz and 5GHz: routers that support both are known as dual-band. You must get one that supports simultaneous dual-band so it can operate on both frequencies at the same time.

Assuming that your wireless devices support 5GHz (many don't), you can connect those you want to use for streaming, gaming and other things that require low latency to the 5GHz network. Because fewer devices (including those owned by your neighbours) use the 5GHz network, it's generally less congested and faster.

Some routers let you control bandwidth to specific IP addresses. It's quite technical, but it means you can set a device on which you want lots of Wi-Fi bandwidth to a static (fixed) IP address, and then set the minimum bandwidth to high figures. Strangely, TP-Link uses 'Ingress' and 'Egress' rather than 'In' and 'Out', or 'Download' and 'Upload'. The actual number you can use might be found only using trial and error. This should improve your Wi-Fi performance.

Quality of Service settings

Another important setting to adjust is that of Quality of Service. If your router has this feature, it will allow you give priority to certain types of applications and/or specific computers. Again, the interface will vary depending on your router, with TP-Link calling it Bandwidth Control.

The internet is your friend, and a quick search for Quality of Service settings, plus your router model or manufacturer, should find a tutorial for your specific router. TP-Link has introduced an app for Android and iOS called Tether that allows you to control your settings via an easy interface on your phone or tablet, and Linksys is doing something similar in their new range.

Depending on the router and model, QoS might only deal with outgoing traffic. This is why it's helpful when playing online games which are time-critical.

Generally, your ISP will control prioritisation of data from the internet to your home, so there's little you can do to ensure you have no buffering issues when others are also using the internet.

Consider a new router

As we mentioned above, it's very common for most of us never to even consider replacing our free routers with more advanced models. In a recent survey conducted by Linksys, it was discovered that nearly 50 percent of respondents were using routers that were running versions of Wi-Fi that were at least 12 years old. This becomes an issue when the same survey reported that 84 percent of those interviewed stated that they regularly streamed movies/TV, while also streaming music, playing games or surfing the internet at the same time.

Replacing your cheap or old router with a newer, more powerful model is an obvious choice, especially if you can convince your family or flatmates to chip in as everyone will benefit. This part of the market is often changing, so it's best to read up on reviews to see which routers offer the best bang for buck. Bear in mind though, that to get the best out of the latest 802.11ac standard that new models offer, you'll need to check that your computers and devices support 802.11ac otherwise they'll behave pretty much the same way they did on the old router.

In fact, it's even more complex, since it isn't enough to merely support 802.11ac. There's also the number of antennas and streams to consider. Your new router might support as many as four simultaneous streams, but your laptop, say, won't be able to take advantage if it has an 802.11ac radio that supports only one stream.

The future

In the next year or so, we will see the introduction of advanced technologies such as MU MIMO (Multi-user Multiple Input Multiple Output), which looks set to make huge improvements to the way routers handle the distribution of information to multiple devices at the same time. Qualcomm's new Streamboost analyses the types of data going through the router so it can automatically prioritise more demanding applications – a sort of Smart Quality of Service, and new triple band routers also offer more capacity for congested connections. These cutting-edge innovations might only be available on a handful of devices at the moment (such as the Linksys EA8500, TP-Link AC3200, and ZyXEL Armor Z1), but as they become more commonplace we should see an easier way to share our digital habits in the future. ☒





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System requirements

Windows 8/8.1/7/Vista (32- and 64-bit), XP (32-bit SP2 or later); 256MB RAM; 300MHz processor; 240MB drive space

Security products need to evolve to keep up with new malware infections and threats. Panda Security 2015 has reinvented the concept of antivirus protection with its Universal Agent architecture. This new technological platform provides better protection capabilities, uses less resources, and is more flexible and stable than ever before.

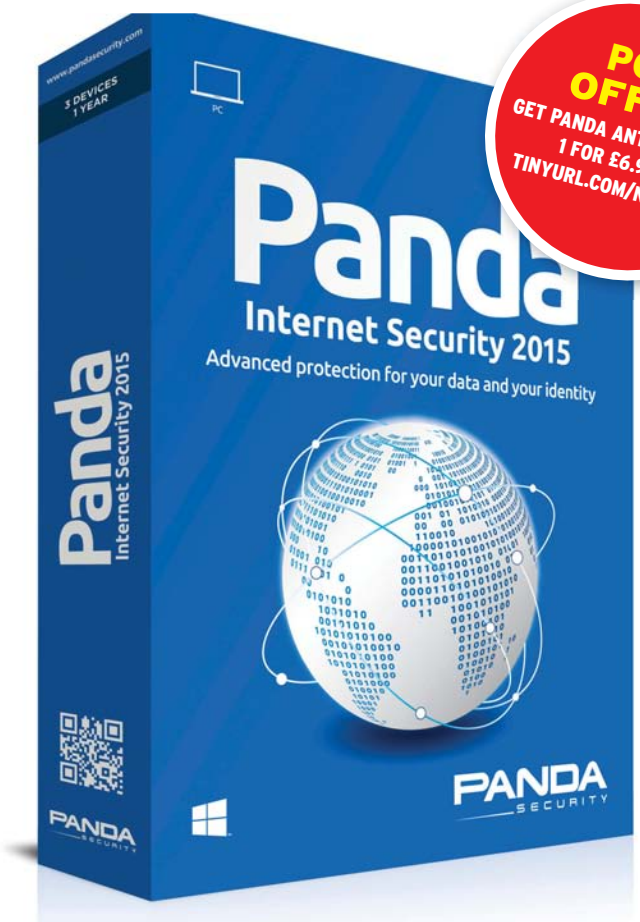
The new architecture, based on Panda's Cloud, provides a greatly improved experience – faster, simpler, more regular updates, all transparent to the user. New antivirus and heuristic engines, with the power and performance of the Cloud Intelligence, protect your PC when online. Plus, there are advanced offline technologies for when you are not connected.

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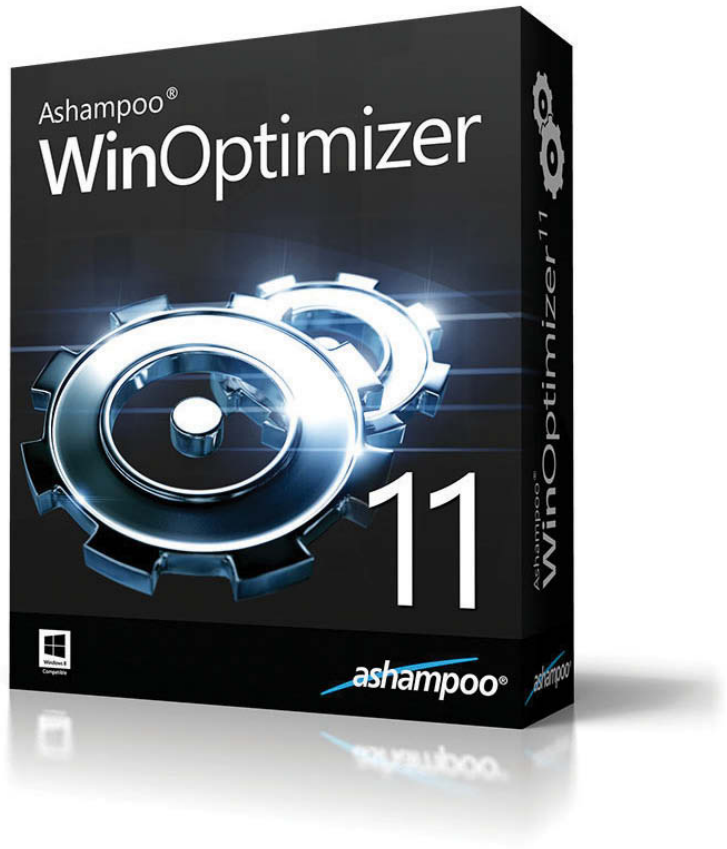
Online registration required: Follow the instructions within the program before 16 September 2015.

System requirements
Windows 8/7/Vista/XP (32-bit); 512MB RAM; 100MB free drive space

We all like fast and secure computers, but only constant system maintenance and time-consuming optimisations will keep them that way. Those who like to invest time and effort in keeping up with the latest developments may handle those tasks using default Windows tools alone. As system experts, they love to accelerate their machines, protect their privacy, clean and back up system files, fix common Windows errors and perform many other tasks. This not only sounds like a lot of work, it is.

For the rest of us there's WinOptimizer 11, which will do all the hard work for you. The software will give you maximum performance and security, and saves you time, so you can get work done instead.





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- Manage system policies easily with User Rights Manager
- Enhanced user experience
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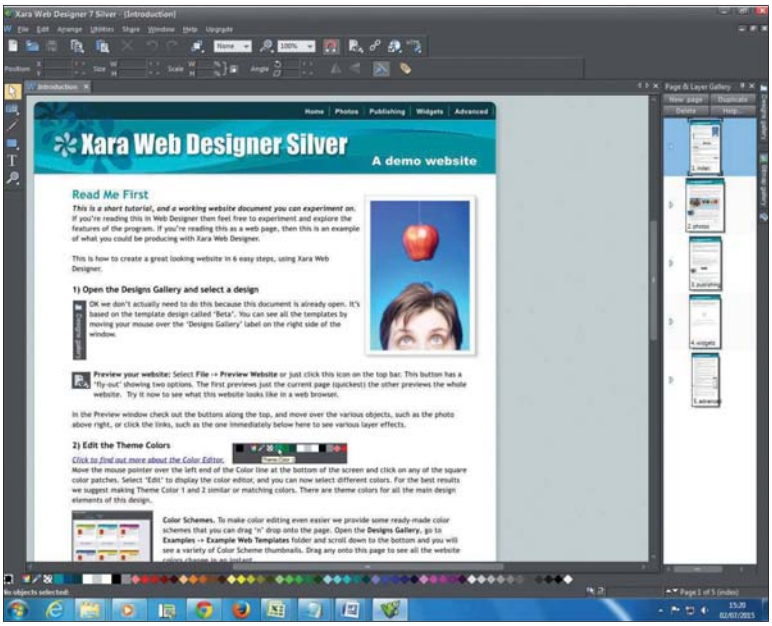
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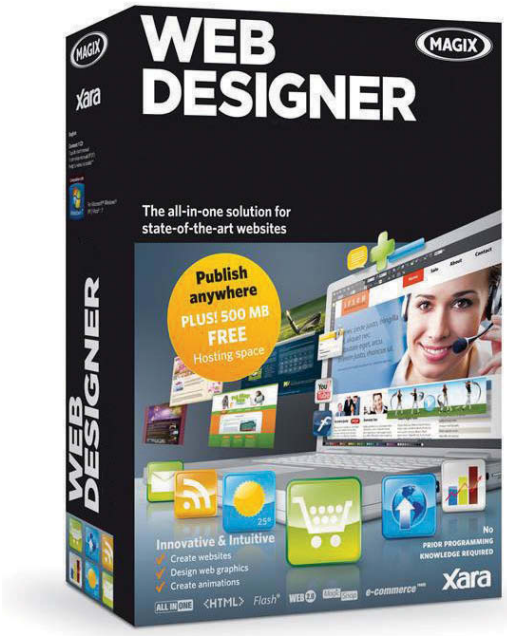
System requirements
Windows XP/Vista/7; 256MB RAM; 200MB drive space

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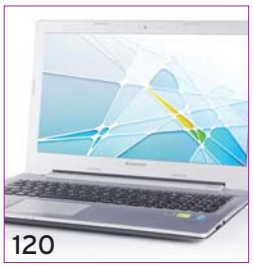
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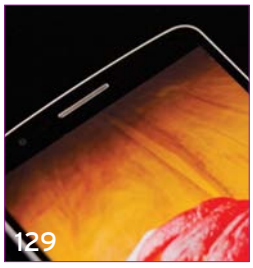

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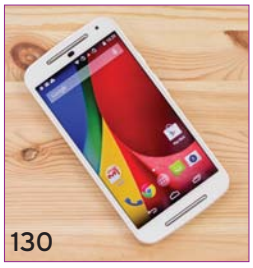

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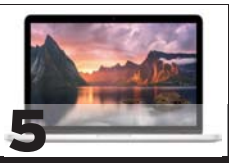
Best laptops











	Aorus X7 v2	Alienware 13	Apple MacBook Pro Retina 15in	HP EliteBook Folio 1040 G1	Apple MacBook Pro Retina 13in
Price	**£1,720 inc VAT**	**£1,100 inc VAT**	**£1,599 inc VAT**	**£2,116 inc VAT**	**£999 inc VAT**
Website	Aorus.com	Alienware.co.uk	Apple.com/uk	Hp.com/uk	Apple.com/uk
Launch date	Sep 14	May 15	June 15	Jan 15	June 15
Build rating	★★★★☆	★★★★½	★★★★½	★★★★½	★★★★½
Features rating	★★★★½	★★★★☆	★★★★½	★★★★½	★★★½☆
Performance rating	★★★★½	★★★★☆	★★★★☆	★★★★½	★★★★☆
Value rating	★★★½☆	★★★★☆	★★★★☆	★★★☆☆	★★★★☆
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★½
Processor	2.4GHz Intel Core i7-4860HQ	2.4GHz Intel Core i7-5500U	2.2GHz Intel Core i7	2.1GHz Intel Core i5-4600U	2.7GHz dual-core Intel Core i5
RAM	16GB DDR3	8GB (2x 4GB) DDR3	16GB DDR3L	8GB DDR3L	8GB LPDDR3
Storage	1TB HDD, 3x 128GB SSD	256GB SSD	256GB SSD	256GB SSD	128GB SSD
Screen size	17.3in matt	13.3in matt	15.4in matt	14in matt	13.3in matt
Screen resolution	1920x1080	1920x1080	2880x1800	1920x1080	2560x1600
Graphics	2x nVidia GeForce GTX 860M	nVidia GeForce GTX 860M	Intel Iris Pro Graphics	Intel HD Graphics 4400	Intel Iris Graphics 6100
Video memory	8GB	2GB	N/A	N/A	N/A
Wireless	802.11a/b/g/n/ac	802.11ac	802.11a/b/g/n/ac	802.11a/b/g/ac	802.11a/b/g/n/ac
Ethernet	Gigabit	Gigabit	Gigabit	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	3x USB 3.0, 2x USB 2.0	3x USB 3.0	2x USB 3.0	2x USB 3.0	2x USB 3.0
FireWire	×	×	×	×	×
Thunderbolt	×	×	✓	×	×
DisplayPort	✓	✓	×	✓	×
HDMI	✓	✓	✓	×	✓
DVI	×	×	×	×	×
VGA	✓	×	×	×	×
eSATA	×	×	×	×	×
Media card slot	✓	×	✓	✓	✓
Audio	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic
Optical drive	N/A	N/A	N/A	N/A	N/A
Extras	HD webcam	2Mp webcam	720p FaceTime	0.9Mp webcam	720p FaceTime
Operating system	Windows 8.1 64-bit	Windows 8.1	OS X Yosemite	Windows 7 Professional	OS X Yosemite
Bundled software	None	None	None	None	None
Gaming scores	189/157fps in Tomb Raider	89/64fps in Tomb Raider	Not tested	49/33fps in Tomb Raider	Not tested
Battery	74.7Wh lithium-polymer	52Wh lithium-polymer	74.9Wh lithium-ion	42Wh lithium-polymer	74.9Wh lithium-ion
Battery life	1 hr 48 mins	10 hrs 20 mins	8 hrs 58 mins	5 hrs 41 mins	17 hrs 5 mins
PCMark7 score	6304	5429	Not tested	4783	Not tested
Dimensions	425x303x24.5mm	328x235x26.7mm	358.9x247.1x18mm	338x232x17.3mm	314x219x18mm
Weight	3.24kg	1.97kg	2.04kg	1.556kg	1.58kg
Warranty	2-year return-to-base	1-year collect-and-return	1-year return-to-base	2-year return-to-base	1-year return-to-base
FULL REVIEW	TINYURL.COM/KLUXLGE	TINYURL.COM/O8VXAGL	TINYURL.COM/O6U4NCR	TINYURL.COM/OWV2FRR	TINYURL.COM/NG98LD4

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Best budget laptops	1 PC ADVISOR RECOMMENDED	2	3	4 PC ADVISOR RECOMMENDED	5
					
	Lenovo IdeaPad Z50-70	**Toshiba Chromebook 2**	**Acer Chromebook 13**	**Dell Chromebook 11**	**Acer Aspire V13**
Price	**£399 inc VAT**	**£269 inc VAT**	**£219 inc VAT**	**£239 inc VAT**	**£410 inc VAT**
Website	Lenovo.com/uk	Toshiba.co.uk	Acer.co.uk	Dell.co.uk	Acer.co.uk
Launch date	Jan 15	Jan 15	Sep 14	Dec 14	Jan 15
Build rating	★★★½☆	★★★★☆	★★★★☆	★★★★☆	★★★☆☆
Features rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Performance rating	★★★½☆	★★★★½	★★★★☆	★★★★☆	★★★★☆
Value rating	★★★½☆	★★★★½	★★★★☆	★★★★☆	★★★★☆
Overall rating	★★★★☆	★★★★½	★★★★☆	★★★★☆	★★★★☆
Processor	1.7GHz Intel Core i3-4010U	Intel Celeron	2.1GHz nVidia Tegra K1	1.4GHz Intel Celeron 2955U	2GHz Intel Core i3-4158U
RAM	4GB DDR3	4GB DDR3	4GB DDR3	4GB DDR3	4GB DDR3
Storage	1TB HDD	16GB SSD	32GB SSD	16GB SSD	500GB HDD with 8GB flash
Screen size	15.6in gloss	13.3in IPS	13.3in	11.6in glossy	13.3in matt
Screen resolution	1920x1080	1920x1080	1920x1080	1366x768	1366x768
Graphics	nVidia GeForce 820M	Intel HD graphics	nVidia Kepler	Intel HD Graphics	Intel Iris Graphics 5100
Video memory	2GB	N/A	N/A	N/A	N/A
Wireless	802.11b/g/n	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n	802.11a/b/g/n
Ethernet	Gigabit	Gigabit	Gigabit	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	1x USB 3.0, 2x USB 2.0	1x USB 3.0, 1x USB 2.0	2x USB 3.0	2x USB 3.0	1x USB 3.0, 1x USB 2.0
FireWire	×	×	×	×	×
Thunderbolt	×	×	×	×	×
DisplayPort	×	×	×	×	×
HDMI	✓	✓	✓	✓	✓
DVI	×	×	×	×	×
VGA	✓	×	×	×	×
eSATA	×	×	×	×	×
Media card slot	✓	✓	✓	✓	✓
Audio	Headphone minijack	Headphone minijack	Headphone minijack	Headphone minijack	Headphone minijack
Optical drive	DVD Writer	None	None	None	None
Extras	None	Webcam	Webcam	Webcam	None
Operating system	Windows 8.1	Google Chrome OS	Google Chrome OS	Google Chrome OS	Windows 8.1
Bundled software	None	None	None	None	None
Battery	41Wh Lithium-ion	9 hrs	9 hrs 20 mins	Lithium	48Wh Lithium-ion
Battery life	4 hrs 58 mins	Not tested	660ms	7 hrs 17 mins	6 hrs 35 mins
PCMark 8 Home score	1959	Not tested	Not tested	N/A	2358 (3396 Work)
Batman (Low/High)	33/29fps	Not tested	Not tested	N/A	29/24fps
Dimensions	382x265x27.5mm	320x214x19.3mm	18x327x227.5mm	295x201x24mm	327x227x20.6mm
Weight	2.4kg	1.35kg	1.5kg	1.3kg	1.5kg
Warranty	1-year return-to-base	1 year	1 year	1-year depot	1-year return-to-base
FULL REVIEW	TINYURL.COM/NJNNKWQ	TINYURL.COM/OP9NQAY	TINYURL.COM/Q2YT5AD	TINYURL.COM/NBUL2NO	TINYURL.COM/OQ94SKB

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Best ultraportable laptops	 1	 2	 3	 4	 5
	Apple MacBook Pro Retina 13in	HP EliteBook Folio 1040 G1	Apple MacBook Air 13in	Dell XPS 13 9343	Microsoft Surface Pro 3
Price	£999 inc VAT	£2,116 inc VAT	£849 inc VAT	£1,099 inc VAT	£639 inc VAT
Website	Apple.com/uk	Hp.com/uk	Apple.com/uk	Dell.co.uk	Microsoft.com/en-gb
Launch date	June 15	Jan 15	April 14	Mar 15	Oct 14
Build rating	★★★★½	★★★★½	★★★★☆	★★★★½	★★★★½
Features rating	★★★½☆	★★★★½	★★★★☆	★★★★☆	★★★★½
Performance rating	★★★★☆	★★★★½	★★★★☆	★★★★½	★★★★☆
Value rating	★★★★☆	★★★☆☆	★★★★☆	★★★★½	★★★½☆
Overall rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Processor	2.7GHz Intel Core i5	2.1GHz Intel Core i5-4600U	1.6GHz Intel Core i5	2.4GHz Intel Core i7-5500U	Intel Haswell Core i3
RAM	8GB LPDDR3	8GB DDR3L	4GB LPDDR3	8GB DDR3	4GB DDR3
Storage	128GB SSD	256GB SSD	128GB SSD	256GB SSD	64GB SSD
Screen size	13.3in matt	14in matt	13.3in glossy	13.3in IPS	12in ClearType
Screen resolution	2560x1600	1920x1080	1440x900	3200x2000	2160x1440
Graphics	Intel Iris Graphics 6100	Intel HD Graphics 4400	Intel HD Graphics 6000	Intel HD Graphics 5500	Intel HD Graphics 4400
Video memory	N/A	N/A	N/A	N/A	N/A
Wireless	802.11a/b/g/n/ac	802.11a/b/g/ac	802.11a/b/g/n/ac	802.11ac	802.11a/b/g/n/ac
Ethernet	Gigabit	Gigabit	None	Gigabit	None
Bluetooth	✓	✓	✓	✓	✓
USB	2x USB 3.0	2x USB 3.0	2x USB 3.0	2x USB 3.0	1x USB 3.0
FireWire	×	×	✓	×	×
Thunderbolt	×	×	✓	×	×
DisplayPort	×	✓	×	×	✓
HDMI	✓	×	×	×	×
DVI	×	×	×	×	×
VGA	×	×	×	×	×
eSATA	×	×	×	×	×
Media card slot	✓	✓	✓	✓	×
Audio	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack	Headphone jack, mic
Optical drive	N/A	N/A	N/A	N/A	N/A
Extras	720p FaceTime	0.9Mp webcam	720p FaceTime	720p webcam	5Mp webcam
Operating system	OS X Yosemite	Windows 7 Professional	OS X Yosemite	Windows 8.1 64-bit	Windows 8.1 Pro
Bundled software	None	None	None	Microsoft Office 2013 Trial	None
Gaming scores	Not tested	49/33fps in Tomb Raider	Not tested	40fps Batman: Arkham City	Not tested
Battery	74.9Wh lithium-ion	42Wh lithium-polymer	38Wh lithium-ion	52Wh lithium-polymer	8000mAh lithium-ion
Battery life	17 hrs 5 mins	5 hrs 41 mins	12 hrs 49 mins	6 hrs 12 mins	9 hrs
PCMark 7 score	Not tested	4783	Not tested	Not tested	Not tested
Dimensions	314x219x18mm	338x232x17.3mm	300x192x17mm	304x200x15mm	292x201.3x9.1mm
Weight	1.58kg	1.556kg	1.35kg	1.3kg	800g
Warranty	1-year return-to-base	2-year return-to-base	1-year return-to-base	1-year next business day	1-year return-to-base
FULL REVIEW	TINYURL.COM/NG98LD4	TINYURL.COM/OWV2FRR	TINYURL.COM/PH3YN5K	TINYURL.COM/PPD3BYW	TINYURL.COM/OLDJ9KK

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Best Chromebooks











	Toshiba Chromebook 2	Acer Chromebook 13	Dell Chromebook 11	HP Chromebook 14	Acer C720p Chromebook
Price	**£269 inc VAT**	**£219 inc VAT**	**£239 inc VAT**	**£259 inc VAT**	**£249 inc VAT**
Website	Toshiba.co.uk	Acer.co.uk	Dell.co.uk	Hp.com/uk	Uk.asus.com
Launch date	Jan 15	Sep 14	Dec 14	Sep 14	Jan 14
Build rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Features rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Performance rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Value rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Overall rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Processor	Intel Celeron	2.1GHz nVidia Tegra K1	1.4GHz Intel Celeron 2955U	1.4GHz Intel Celeron 2955U	1.4GHz Intel Celeron 2955U
RAM	4GB DDR3	4GB DDR3	4GB DDR3	4GB DDR3	2GB DDR3
Storage	16GB SSD	32GB SSD	16GB SSD	16GB SSD	16GB SSD
Screen size	13.3in IPS	13.3in	11.6in glossy	14in glossy	11.6in glossy
Screen resolution	1920x1080	1920x1080	1366x768	1366x768	1366x768
Graphics	Intel HD graphics	nVidia Kepler	Intel HD Graphics	Intel HD graphics	Intel HD graphics
Video memory	N/A	N/A	N/A	N/A	N/A
Wireless	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n	802.11a/b/g/n	802.11a/b/g/n
Ethernet	Gigabit	Gigabit	Gigabit	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	1x USB 3.0, 1x USB 2.0	2x USB 3.0	2x USB 3.0	2x USB 3.0, 1x USB 2.0	1x USB 3.0, 1x USB 2.0
FireWire	×	×	×	×	×
Thunderbolt	×	×	×	×	×
DisplayPort	×	×	×	×	×
HDMI	✓	✓	✓	✓	✓
DVI	×	×	×	×	×
VGA	×	×	×	×	×
eSATA	×	×	×	×	×
Media card slot	✓	✓	✓	✓	✓
Audio	Headphone minijack	Headphone minijack	Headphone minijack	Headphone minijack	Headphone minijack
Optical drive	None	None	None	None	None
Extras	Webcam	Webcam	Webcam	Webcam	Webcam
Operating system	Google Chrome OS	Google Chrome OS	Google Chrome OS	Google Chrome OS	Google Chrome OS
Bundled software	None	None	None	None	None
Battery life	9 hrs	9 hrs 20 mins	7 hrs 17 mins	7 hrs 50 mins	6 hrs 7 mins
SunSpider score	Not tested	660ms	465ms	470ms	502ms
Peacekeeper score	Not tested	Not tested	2468	2478	2453
Browsermark score	Not tested	Not tested	3732	3643	3698
Dimensions	320x214x19.3mm	18x327x227.5mm	295x201x24mm	20.5x345x239mm	19.1x288x204mm
Weight	1.35kg	1.5kg	1.3kg	1.7kg	1.35kg
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/OP9NQAY	TINYURL.COM/Q2YT5AD	TINYURL.COM/M3D3QJ4	TINYURL.COM/OCU7FTY	TINYURL.COM/O9KFZMA

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Best gaming laptops











	Aorus X7 v2	Alienware 13	MSI GS60 2QD-470UK	Gigabyte P37X	Aorus X7 Pro
Price	**£1,720 inc VAT**	**£1,100 inc VAT**	**£1,299 inc VAT**	**£1,750 inc VAT**	**£2,100 inc VAT**
Website	Aorus.com	Alienware.co.uk	UK.msi.com	Uk.gigabyte.com	Aorus.com
Launch date	Sep 14	May 15	May 15	May 15	Jan 15
Build rating	★★★★☆	★★★★½	★★★★☆	★★★½☆	★★★★☆
Features rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★½
Performance rating	★★★★½	★★★★☆	★★★★☆	★★★½☆	★★★★½
Value rating	★★★½☆	★★★★☆	★★★★☆	★★★★½	★★★½☆
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★☆	★★★★☆
Processor	2.4GHz Intel Core i7-4860HQ	2.4GHz Intel Core i7-5500U	2.6GHz Intel Core i7-4720HQ	2.6GHz Intel Core i7-4720HQ	2.4GHz Intel Core i7-4860HQ
RAM	16GB DDR3	8GB (2x 4GB) DDR3	16GB (2x 8BG) DDR3	16GB DDR3	16GB DDR3
Storage	1TB HDD, 3x 128GB SSD	256GB SSD	1TB HDD, 128GB SSD	2x 128GB SSD, 1TB HDD	2x 256GB SSD
Screen size	17.3in matt	13.3in matt	15.6in matt	17.3in matt	17.3in matt
Screen resolution	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080
Graphics	2x nVidia GeForce GTX 860M	nVidia GeForce GTX 860M	nVidia GeForce GTX 965M	nVidia GeForce GTX 980M	2x nVidia GTX 870M
Video memory	8GB	2GB	3GB	8GB	6GB
Wireless	802.11a/b/g/n/ac	802.11ac	802.11ac	802.11ac	802.11a/b/g/n/ac
Ethernet	Gigabit	Gigabit	Gigabit	Gigabit	Gigabit
Bluetooth	✓	✓	✓	✓	✓
USB	3x USB 3.0, 2x USB 2.0	3x USB 3.0	3x USB 3.0	2x USB 3.0, 2x USB 2.0	3x USB 3.0, 2x USB 2.0
FireWire	×	×	×	×	×
Thunderbolt	×	×	×	×	×
DisplayPort	✓	✓	×	✓	✓
HDMI	✓	✓	×	✓	✓
DVI	×	×	×	×	×
VGA	✓	×	×	✓	✓
eSATA	×	×	×	×	×
Media card slot	✓	×	✓	✓	✓
Audio	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic	Headphone jack, mic
Optical drive	N/A	N/A	N/A	N/A	N/A
Extras	HD webcam	2Mp webcam	2.1Mp webcam	0.9Mp webcam	HD webcam
Operating system	Windows 8.1 64-bit	Windows 8.1	Windows 8.1	Windows 8.1	Windows 8.1 64-bit
Bundled software	None	None	None	None	None
Gaming scores	189/157fps in Tomb Raider	89/64fps in Tomb Raider	123/82fps in Tomb Raider	221/153fps in Tomb Raider	221/170fps in Tomb Raider
Battery	74.7Wh lithium-polymer	52Wh lithium-polymer	48Wh lithium-ion	78Wh lithium-polymer	74.7Wh lithium-polymer
Battery life	1 hr 48 mins	10 hrs 20 mins	2 hrs 49 mins	4 hrs 2 mins	1 hr 48 mins
PCMark 7 score	6304	5429	6241	6305	6474
Dimensions	425x303x24.5mm	328x235x26.7mm	389x265x20.3mm	415x286x23.2mm	425x303x24.5mm
Weight	3.24kg	1.97kg	2.04kg	2.89kg	3.24kg
Warranty	2-year return-to-base	1-year collect-and-return	2-year return-to-base	2-year	2-year return-to-base
FULL REVIEW	TINYURL.COM/KLUXLGE	TINYURL.COM/O8VXAGL	TINYURL.COM/O6Q3JJD	TINYURL.COM/NDPC6P6	TINYURL.COM/OZVQ6JQ

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Best family PCs











	Chillblast Fusion Commando	Wired2Fire Diablo Reactor	Chillblast Fusion Pharoah	Mesh Elite 4670-PCA	Dino PC Raging Lizard V2
Price	**£799 inc VAT**	**£668 inc VAT**	**£799 inc VAT**	**£799 inc VAT**	**£780 inc VAT**
Website	Chillblast.com	Wired2fire.co.uk	Chillblast.com	Meshcomputers.com	Dinopc.com
Launch date	Jul 13	May 14	May 14	May 14	May 14
Build rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★½☆
Features rating	★★★★☆	★★★½☆	★★★★★	★★★★½	★★★½☆
Performance rating	★★★★½	★★★★½	★★★★★	★★★★½	★★★★☆
Value rating	★★★★☆	★★★★½	★★★★☆	★★★★☆	★★★★☆
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★☆
Processor	3.2GHz Intel Core i5-4570	3.4GHz Intel Core i5-4670	3.5GHz Intel Core i5-4690	3.4GHz Intel Core i5-4670	3.5GHz Intel Core i5-4690
RAM	16GB DDR3	8GB DDR3 1600MHz	16GB DDR3 1600MHz	16GB DDR3 1600MHz	8GB DDR3 1600MHz
Storage	1TB HDD + 120GB SSD	1TB HDD	1TB HDD + 120GB SSD	2TB HDD + 120GB SSD	1TB HDD + 128GB SSD
Motherboard	Asus B85M-G	Asus B85M-G	Asus B85M-G	MSI B85M-E45	Gigabyte H97M-D3H
CPU cooler	Arctic Cooling Freezer 7 Pro	Standard Intel Cooler	Standard Intel Cooler	Standard Intel Cooler	Standard Intel Cooler
Power supply	600W CiT	500W FSP	500W FSP	500W FSP	500W CIT
Screen	23in Iiyama X2377	24in AOC E2495Sh	23in Asus VS239HV	24in Iiyama E2483HS-B1	24in Iiyama E2483HS-B1
Screen resolution	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080
Graphics	Zotac nVidia GeForce GTX 650 Ti	AMD Radeon R7 265	AMD Radeon R7 265	nVidia GeForce GTX 750 Ti	nVidia GeForce GTX 750 Ti
Video memory	N/A	2GB	2GB	2GB	2GB
Connectivity	802.11b/g/n, gigabit ethernet	Gigabit ethernet	Gigabit ethernet	Gigabit ethernet	Gigabit ethernet, 802.11b/g/n
USB	3x USB 3.0, 6x USB 2.0	3x USB 3.0, 6x USB 2.0, 2x HDMI, VGA	3x USB 3.0, 6x USB 2.0, 2x DVI, 2x HDMI, DP, VGA	4x USB 3.0, 8x USB 2.0, HDMI, VGA, DVI-D, DVI, DP	5x USB 3.0, 3x USB 2.0, 2x HDMI (1x e-Mini), VGA, 2x DVI
Media card slot	None	None	None	None	None
Sound	Onboard	Onboard	Onboard	Onboard	Onboard
Speakers	2x Logitech LS220	None	None	None	None
Case	Cooler Master Force 500	Zalman Z3 Plus	Zalman Z3 Plus	Zalman Z3 Plus	Fractal Design Core 1000 USB3
Keyboard	Logitech MK260	Octigen wireless combo	Logitech MK270 (wireless combo)	Logitech MK270 (wireless combo)	Gigabyte KM6150 (wired combo)
Optical drive	LG BD-ROM/DVD±RW	LiteOn DVD±RW	LiteOn BD-ROM/DVD±RW	24x DVD RW	None
Operating system	Windows 8 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit
Bundled software	None	None	None	None	None
Sniper V2 Elite score (Low/High/Ultra)	147/59/14fps	240/76/18fps	240/76/18fps	195/68/16fps	196/83/20fps
Alien vs Predator score (720p/1080p)	52/27fps	83/44fps	83/44fps	71/37fps	102/53fps
PCMark 7 score	6177	3938	5953	7304	6431
Warranty	2-year collect-and-return	2-year return-to-base	5-year labour, 2-year collect-and-return	3-years labour (2-year parts, 3-months free C&R)	3-year labour (2-year parts)
FULL REVIEW	TINYURL.COM/KF6G3T7	TINYURL.COM/OA8UKDP	TINYURL.COM/K2KF83U	TINYURL.COM/OZCSHYU	TINYURL.COM/PFA55F7

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Asus Z97I-PLUS Motherboard
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GeForce GT 620 1GB GPU
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*** World`s fastest PC as tested by PC Pro Magazine http://www.pcpro.co.uk/reviews/desktops/371152/chillblast-fusion-photo-oc-iv

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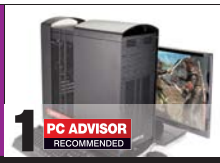
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Best gaming PCs

	1 PC ADVISOR RECOMMENDED	2 PC ADVISOR RECOMMENDED	3	4	5 PC ADVISOR RECOMMENDED
					
	Eclipse SuperNova i5r285oc	**Dino PC Dark Spark GTX 960**	**Cyberpower Infinity Achilles**	**Chillblast Fusion Mantis**	**Yoyotech Warbird Gam3r**
Price	**£999 inc VAT**	**£999 inc VAT**	**£999 inc VAT**	**£749 inc VAT**	**£999 inc VAT**
Website	Eclipsecomputers.com	Dinopc.com	Cyberpowersystem.co.uk	Chillblast.com	Yoyotech.co.uk
Launch date	Mar 15	Mar 15	Mar 15	Mar 15	April 15
Build rating	★★★★★	★★★★½	★★★★½	★★★★½	★★★★★
Features rating	★★★★★	★★★★★	★★★★½	★★★☆☆	★★★★½
Performance rating	★★★★☆	★★★★☆	★★★★½	★★★½☆	★★★★½
Value rating	★★★★☆	★★★★☆	★★★½☆	★★★★★	★★★½☆
Overall rating	★★★★½	★★★★½	★★★★½	★★★★½	★★★★½
Processor	3.5GHz Intel Core i5-4690K (OC 4.4GHz)	3.5GHz Intel i5-4670K (OC 4.6GHz)	3.5GHz Intel Core i5-4690K	3.5GHz Intel Core i5-4690K (OC 4.2GHz)	3.5GHz Intel Core i5 4690K (4.2GHz OC)
CPU cooler	Zalman CNPS11X Extreme	Be Quiet Pure Rock BK009	Cooler Master Seidon 120mm RL-S12M-FLNN-S1	Corsair H55 Water Cooler	SilentiumPC Fera 2 Heatpipe Cooler
Memory	16GB HyperX Savage	8GB DDR3	8GB DDR3	8GB DDR3	8GB DDR3
Storage	2TB HDD + 250GB SSD	1TB HDD + 120GB SSD	1TG HDD + 120GB SSD	1TB SSHD	2TB HDD + 240GB SSD
Power supply	550W XFX Core Edition	450W Corsair	600W Cooler Master	600W Corsair	600W Aerocool Integrator
Motherboard	Asus Z97-K	Gigabyte Z97X-Gaming 3	Gigabyte H81M-S2H	Gigabyte Z97-HD3	MSI Z97M-G43
Operating system	Windows 8.1	Windows 8.1	Windows 8.1	Windows 8.1 64-bit	Windows 8.1
Screen	26in HKC 2615	24in Iiyama GE2488HS-B1	24in AOC E2470SWDA	None supplied	23.6in AOC I2476VWM
Graphics	XFX AMD Radeon R9 285 DD Edition	Palit nVidia GeForce GTX 690	MSI nVidia GeForce GTX 970	MSI GeForce GTX 960	MSI nVidia GTX970 4GB
Sound	Onboard	Onboard	Onboard	Onboard	Onboard
Connectivity	Gigabit ethernet	Gigabit ethernet	Gigabit ethernet	Gigabit ethernet	Gigabit ethernet
Ports	6x USB 3.0, 4x USB 2.0	6x USB 3.0, 4x USB 2.0, 2x PS/2, D-Sub, DVI-D, 6x SATA	6x USB 3.0, 3x USB 2.0, 2x DVI, HDMI, DP	6x USB 3.0, 2x USB 2.0, 2x DVI, HDMI, DP, PS/2	6x USB 3.0, 2x USB 2.0
Optical drive	Samsung DVD±RW	None	None	None	DVD±RW
Case	XFX Type 1 Bravo	NZXT Source 340	NZXT Source 340 Black	NZXT Source 340	CIT Kube Case
Keyboard & mouse	Cooler Master Storm Devastator Set	Corsair	Cooler Master Devastator Keyboard and Mouse	None	Gamdias Ares Keyboard and Mouse
Other	None	Corsair Raptor Bundle	None	Chillblast Family Software pack (optional)	None
PCMark 7 score	7931	7090	5945	5823	6244
Alien vs Predator score (720p/1080p)	111.4/59.8fps	103.4/54.7	167.8/89fps	104.2/55.2fps	1169.2/89.6fps
Final Fantasy XIV (Maximum)	91fps	86fps	120fps	86fps	137fps
Sniper Elite V2 (Low/Medium/Ultra)	292.1/106.8/26.5fps	285.6/123.6/28.9fps	281.1/192.9/48.1fpsfps	289.3/123.8/29fps	429.4/204.3/49.1fps
Power Consumption	76/432W	77/310W	48/261W	50/277W	72/369W
Warranty	3-year return-to-base	3-year PromoCare	2-year parts, 3-year return-to-base, 30-day C&R	5-year labour (2-year collect-and-return)	1-year RTB (3-year labour only), 90-day C&R
FULL REVIEW	TINYURL.COM/K5AJLBO	TINYURL.COM/MVBK6KX	TINYURL.COM/KKKRXAD	TINYURL.COM/L5H9ZDR	TINYURL.COM/NWZZZBM

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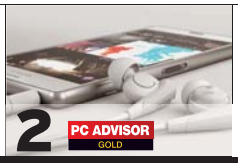
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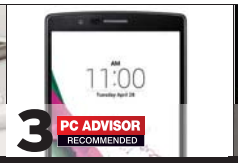
	1 PC ADVISOR RECOMMENDED	2	3	4	5
	Apple iMac with 5K display	Acer Aspire AZ3-615	Chillblast Volante AIO	Asus Eee Top	HP Envy Beats 23-n001na
Price	£1,999 inc VAT	£799 inc VAT	£1,299 inc VAT	£799 inc VAT	£900 inc VAT
Website	Apple.com/uk	Acer.co.uk	Chillblast.com	Asus.com/uk	Hp.com/uk
Launch date	Dec 14	Dec 14	Dec 14	Dec 14	Dec 14
Build rating	★★★★★	★★★½☆	★★★☆☆	★★★½☆	★★★★☆
Features rating	★★★★★	★★½☆☆	★★★★☆	★★★★☆	★★★☆☆
Performance rating	★★★★☆	★★★½☆	★★★★★	★★½☆☆	★★½☆☆
Value rating	★★★★½	★★★★☆	★★★★☆	★★★☆☆	★★★½☆
Overall rating	★★★★★	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Processor	3.9GHz Intel Core i5-4690	2.7GHz Intel Core i5-4460T	4GHz Intel Core i7-4790S	2.6GHz Intel Core i5-4200U	3.2GHz Intel Core i7-4785T
RAM	8GB DDR3	8GB DDR3	16GB DDR3	6GB DDR3	8GB DDR3
Storage	1TB Fusion Drive	1TB HDD	1TB SSD	1TB HDD	1TB HDD
Screen	27in	23in touchscreen	24in	23in touchscreen	23in touchscreen
Screen resolution	5120x2880	1920x1080	1920x1080	1920x1080	1920x1080
Graphics card	AMD Radeon M9 M290X	nVidia GeForce GT 840M	nVidia GeForce GT 750M	Intel HD Graphics 4400	Intel HD Graphics 4600
Video memory	2GB	2GB	2GB	N/A	N/A
Wireless	802.11b/g/n	802.11b/g/n	802.11b/g/n	802.11b/g/n	802.11b/g/n
Ethernet	Gigabit	Gigabit	Gigabit	Gigabit	Gigabit
Bluetooth	×	×	×	×	×
USB	4x USB 3.0	2x USB 3.0, 3x USB 2.0	4x USB 3.0, 2x USB 2.0	3x USB 3.0, 3x USB 2.0	2x USB 3.0, 4x USB 2.0
FireWire	×	×	×	×	×
Thunderbolt	✓	×	×	×	×
HDMI	×	×	✓	✓	✓
Media card slot	✓	✓	✓	✓	✓
Optical drive	None	DVD Writer	Blu-Ray Combo	DVD Writer	DVD Writer
Other	Final Cut Pro X, Logic Pro X, Aperture	1Mp webcam, wireless keyboard and mouse	Logitech MK520 wireless keyboard and mouse	2Mp webcam, Freeview TV, wireless keyboard and mouse	Wireless keyboard and mouse, Beats Audio stereo speaker system (8x 12W)
Operating system	OS X Yosemite	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit	Windows 8.1 64-bit
Power consumption (idle/max)	46/215W	46/91W	35/177W	33/69W	43/81W
Sniper V2 Elite (Low/High/Ultra)	Not tested	47.7/18.7/5.1fps	91.5/41.2/10.5fps	31.4/7.8/5fps	27.7/7.4/5fps
PCMark 8 Home score	Not tested	2906	3776	2828	2702
Dimensions	650x203x516mm	540x489x579mm	585x200x450mm	571x359x50-214mm	563x143x413mm
Weight	9.54kg	8.8kg	14.6kg	9kg	8.4kg
Warranty	1-year return-to-base	Not stated	5-year labour (2-year collect-and-return)	1-year return-to-base	1-year limited parts, labour, and pickup-and-return service
FULL REVIEW	TINYURL.COM/NWJUJSF	TINYURL.COM/QEY8FOE	TINYURL.COM/LO8A5MC	TINYURL.COM/PRPHC7L	TINYURL.COM/O6M4BCN

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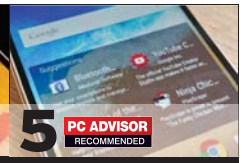
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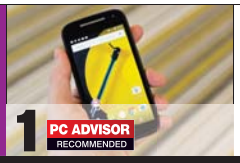




	Samsung Galaxy S6	Sony Xperia Z3 Compact	LG G4	LG G3	HTC One M9
Price	**£349 inc VAT**	**£349 inc VAT**	**£500 inc VAT**	**£479 inc VAT**	**£579 inc VAT**
Website	Samsung.com/uk	Sony.co.uk	Lg.com/uk	Lg.com/uk	HTC.com/uk
Launch date	Apr 15	Sep 14	May 15	May 14	Mar 15
Build rating	★★★★½	★★★★½	★★★★☆	★★★★½	★★★★½
Features rating	★★★★½	★★★★☆	★★★★☆	★★★★½	★★★★☆
Performance rating	★★★★½	★★★★½	★★★★☆	★★★★½	★★★★☆
Value rating	★★★★☆	★★★★★	★★★★½	★★★★½	★★★½☆
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★½	★★★★☆
OS (out of box)	Android 5.0 Lollipop	Android 4.4 KitKat	Android 5.1 Lollipop	Android 4.4 KitKat	Android 5.0 Lollipop
Processor	2.1GHz Exynos 7420	2.5GHz Snapdragon 801	Snapdragon 808 six-core	2.5GHz Snapdragon 801	Snapdragon 810 octa-core
RAM	3GB	2GB	3GB	2GB/3GB	3GB
Storage	32/64GB	16GB	32GB	16GB/32GB	32GB
MicroSD support	No	Up to 128GB	Up to 128GB	No	Up to 128GB
Graphics	Mali-T760 GPU	Adreno 330	Adreno 418	Adreno 330	Adreno 430
Screen size	5.1in	4.6in	4.5in	5.5in	5in
Screen resolution	1440x2560	720x1280	1440x2560	1440x2560	1080x1920
Pixel density	577ppi	319ppi	538ppi	534ppi	441ppi
Screen technology	Super AMOLED	IPS	IPS	IPS	IPS
Front camera	5Mp	2.2Mp	8Mp	2Mp	4Mp (UltraPixel)
Rear camera	16Mp, LED flash	20.7Mp, LED flash	16Mp	13Mp, LED flash	20Mp
Video recording	4K	4K	4K	4K	4K
Cellular connectivity	4G	4G	4G	4G	4G
SIM type	Nano-SIM	Nano-SIM	Micro-SIM	Micro-SIM	Nano-SIM
Dual-SIM as standard	No	No	No	No	No
Wi-Fi	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band
Bluetooth	Bluetooth 4.1	Bluetooth 4.0	Bluetooth 4.1	Bluetooth 4.0 (aptX)	Bluetooth 4.1 (aptX)
GPS	GPS, Glonass	A-GPS, Glonass	A-GPS, Glonass	A-GPS, Glonass	GPS, Glonass
NFC	Yes	Yes	Yes	Yes	Yes
USB OTG	Yes	Yes	Yes	Yes	Yes
Extra features	Heart-rate sensor, fingerprint scanner	Waterproof, PS4 Remote Play	24-bit/192kHz audio, rear key	24-bit/192kHz audio, rear key	BoomSound speakers
Geekbench 3.0 (single)	1347	Not tested	Not tested	Not tested	1160
Geekbench 3.0 (multi)	4438	2800	3513	2465	3378
SunSpider	1048ms	944ms	715ms	959ms	867ms
GFXBench: T-Rex	30fps	41fps	25fps	20fps	50fps
GFXBench: Manhattan	14fps	26fps	9fps	Not tested	24fps
Battery	2550mAh, non-removable	2600mAh, non-removable	3000mAh removable	3000mAh, removable, Qi	2840mAh, non-removable
Dimensions	143.4x70.5x6.8mm	64.9x127x8.6mm	64.9x127x8.6mm	75x146x8.9mm	70x145x9.7mm
Weight	138g	129g	155g	149g	157g
Warranty	1 year	2 years	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/PC2KOYQ	TINYURL.COM/NBBUY82	TINYURL.COM/NBBUY82	TINYURL.COM/OA76T73	TINYURL.COM/PUS2XEJ

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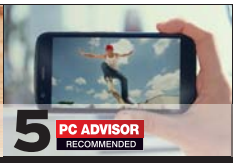
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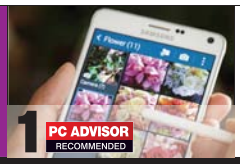




	Motorola Moto E 4G 2015	Vodafone Smart Prime 6	EE Harrier Mini	Motorola Moto G 3G 2014	Motorola Moto G 4G 2014
Price	£109 inc VAT	£79 inc VAT	£99 inc VAT	£140 inc VAT	£117 inc VAT
Website	Motorola.co.uk	Vodafone.co.uk	EE.co.uk	Motorola.co.uk	Motorola.co.uk
Launch date	Feb 15	June 15	June 15	Sep 14	May 14
Build rating	★★★★☆	★★★★½	★★★★☆	★★★★☆	★★★★½
Features rating	★★★★☆	★★★★☆	★★★½☆	★★★★☆	★★★★☆
Performance rating	★★★★☆	★★★★★	★★★½☆	★★★★☆	★★★★☆
Value rating	★★★★★	★★★★☆	★★★★½	★★★★☆	★★★★★
Overall rating	★★★★☆	★★★★½	★★★★☆	★★★★☆	★★★★½
OS (out of box)	Android 5.0 Lollipop	Android 5.0.2 Lollipop	Android 5.0 Lollipop	Android 4.4 KitKat	Android 4.4 KitKat
Processor	1.2GHz Snapdragon 410	1.2GHz Snapdragon 410	1.2GHz	1.2GHz Snapdragon 400	1.2GHz Snapdragon 400
RAM	1GB	1GB	1GB	1GB	1GB
Storage	8GB	8GB	8GB	8GB	8GB
MicroSD support	Up to 32GB	Up to 64GB	Not stated	Up to 32GB	Up to 32GB
Graphics	Adreno 306	Adreno 306	Not stated	Adreno 305	Adreno 305
Screen size	4.5in	5in	4.7in	5in	4.5in
Screen resolution	540x960	720x1280	720x1280	720x1280	720x1280
Pixel density	245ppi	294ppi	312ppi	294ppi	326ppi
Screen technology	IPS	IPS	IPS	IPS	IPS
Front camera	0.3Mp	2Mp	2Mp	2Mp	1.3Mp
Rear camera	5Mp	8Mp	8Mp, LED flash	8Mp, LED flash	5Mp, LED flash
Video recording	720p	1080p	720p	720p	720p
Cellular connectivity	4G	4G	4G	3G	4G
SIM type	Micro-SIM	Micro-SIM	Micro-SIM	Micro-SIM	Micro-SIM
Dual-SIM as standard	No	No	No	Yes	No
Wi-Fi	802.11b/g/n	802.11b/g/n	802.11b/g/n	802.11b/g/n	802.11b/g/n
Bluetooth	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.0
GPS	GPS, A-GPS, Glonass	A-GPS	A-GPS, Glonass	A-GPS, Glonass	A-GPS, Glonass
NFC	No	No	No	No	No
USB OTG	No	Yes	Yes	Yes	Yes
Extra features	Double-twist launches camera, lockscreen alerts	FM radio	Wi-Fi calling	Stereo speakers	None
Geekbench 3.0 (single)	464	464	Not tested	340	334
Geekbench 3.0 (multi)	1463	1401	1549	1144	1168
SunSpider	1301ms	1301ms	1880ms	1526ms	1504ms
GFXBench: T-Rex	13fps	9.4fps	10fps	11fps	11fps
GFXBench: Manhattan	6fps	3.8fps	4fps	4fps	Not tested
Battery	2390mAh, non-removable	N/S, non-removable	2000mAh, non-removable	2390mAh, non-removable	2070mAh, non-removable
Dimensions	66.8x5.2-12.3x129.9mm	141.65x71.89x9mm	138x67.9x9.5mm	71x142x11mm	66x130x11.6mm
Weight	145g	155g	124g	155g	143g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/Q7Q9NXR	TINYURL.COM/Q5DSNHE	TINYURL.COM/PXTROH4	TINYURL.COM/OAE6AH5	TINYURL.COM/ONOLUT7

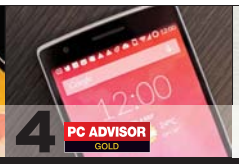
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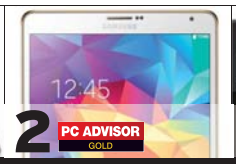


	Samsung Galaxy Note 4	LG G4	LG G3	OnePlus One	Google Nexus 6
Price	**£599 inc VAT**	**£500 inc VAT**	**£479 inc VAT**	**£229 inc VAT**	**£499 inc VAT**
Website	Samsung.com/uk	Lg.com/uk	Lg.com/uk	Oneplus.net	Play.google.com
Launch date	Sep 14	May 15	May 14	Jul 14	Oct 14
Build rating	★★★★☆	★★★★☆	★★★★½	★★★★☆	★★★★☆
Features rating	★★★★½	★★★★☆	★★★★½	★★★½☆	★★★★☆
Performance rating	★★★★☆	★★★★☆	★★★★½	★★★★☆	★★★★☆
Value rating	★★★★☆	★★★★½	★★★★½	★★★★★	★★★½☆
Overall rating	★★★★☆	★★★★☆	★★★★½	★★★★½	★★★★☆
OS (out of box)	Android 4.4 KitKat	Android 5.1 Lollipop	Android 4.4 KitKat	Cyanogen 11S (Android 4.4)	Android 5.0 Lollipop
Processor	2.7GHz Snapdragon 805	1.82GHz Snapdragon 808	2.5GHz Snapdragon 801	2.5GHz Snapdragon 801	2.7GHz Snapdragon 805
RAM	3GB	3GB	2GB/3GB	3GB	3GB
Storage	32GB	32GB	16GB/32GB	16GB/64GB	32GB/64GB
MicroSD support	Up to 128GB	Up to 128GB	No	No	No
Graphics	Adreno 420	Adreno 418	Adreno 330	Adreno 330	Adreno 420
Screen size	5.7in	5.5in	5.5in	5.5in	5.96in
Screen resolution	1440x2560	1440x2560	1440x2560	1920x1080	1440x2560
Pixel density	515ppi	538ppi	534ppi	401ppi	493ppi
Screen technology	Super AMOLED	IPS	IPS	IPS	IPS
Front camera	3.7Mp	8Mp	2Mp	5Mp	2Mp
Rear camera	16Mp, LED flash	16Mp, LED flash	13Mp, LED flash	13Mp, LED flash	13Mp, LED flash
Video recording	4K	4K	4K	4K	4K
Cellular connectivity	4G	4G	4G	4G	4G
SIM type	Micro-SIM	Micro-SIM	Micro-SIM	Micro-SIM	Nano-SIM
Dual-SIM as standard	No	No	No	No	No
Wi-Fi	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band	802.11b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band
Bluetooth	Bluetooth 4.1	Bluetooth 4.0	Bluetooth 4.0 (aptX)	Bluetooth 4.0	Bluetooth 4.1
GPS	GPS, Glonass	A-GPS, Glonass	A-GPS, Glonass	GPS, Glonass	GPS, Glonass
NFC	Yes	Yes	Yes	Yes	Yes
USB OTG	Yes	Yes	Yes	Yes	Yes
Extra features	Fingerprint, UV, heart-rate sensors, S Pen stylus	24bit/192kHz audio, rear key, IR blaster	24bit/192kHz audio, rear key	None	None
Geekbench 3.0 (single)	Not tested	Not tested	Not tested	969	Not tested
Geekbench 3.0 (multi)	3272	3513	2465	2570	3304
SunSpider	1367ms	715ms	959ms	877ms	791ms
GFXBench: T-Rex	27fps	25fps	20fps	29fps	27fps
GFXBench: Manhattan	11fps	9fps	Not tested	Not tested	12fps
Battery	3220mAh, removable	3000mAh, removable, Qi	3000mAh, removable, Qi	3100mAh, non-removable	3220mAh, non-removable, Qi
Dimensions	78.6x153.5x8.5mm	76x149x6.3-9.8mm	75x146x8.9mm	75.9x152.9x8.9mm	82x159x10.4mm
Weight	176g	155g	149g	162g	183g
Warranty	2 years	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/PNHJCZ4	TINYURL.COM/QDGU48T	TINYURL.COM/OA76T73	TINYURL.COM/PK3S5CP	TINYURL.COM/NLZ4UD9

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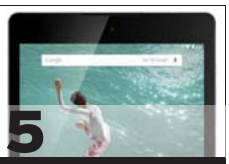
Best 7- & 8in tablets







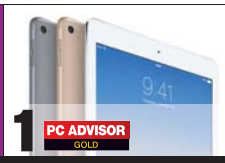




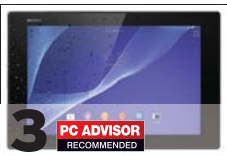
	Google Nexus 7	Samsung Galaxy Tab S 8.4	Sony Xperia Z3 Tablet Compact	Apple iPad mini 2	Google Nexus 9
Price	**£199 inc VAT**	**£319 inc VAT**	**£299 inc VAT**	**£239 inc VAT**	**£319 inc VAT**
Website	Play.google.com	Samsung.com/uk	Sony.co.uk	Apple.com/uk	Play.google.com
Launch date	Aug 13	Aug 14	Sep 14	Oct 13	Oct 14
Build rating	★★★★☆	★★★★☆	★★★★☆	★★★★½	★★★½☆
Features rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★☆
Performance rating	★★★★½	★★★★½	★★★★½	★★★★½	★★★★½
Value rating	★★★★½	★★★★½	★★★★☆	★★★★☆	★★★★☆
Overall rating	★★★★½	★★★★½	★★★★½	★★★★½	★★★★☆
OS (out of box)	Android 4.3 Jelly Bean	Android 4.4 KitKat	Android 4.4 KitKat	iOS 8.2	Android 5.0 Lollipop
Processor	1.5GHz Snapdragon S4 Pro	Exynos 5420, octa-core	2.5GHz Snapdragon 801	Apple A7, Apple M7	2.3GHz nVidia Tegra K1
RAM	2GB	3GB	3GB	1GB	2GB
Storage	16GB/32GB	16GB/32GB	16GB/32GB	16GB/32GB	16GB/32GB
MicroSD support	No	Up to 128GB	Up to 128GB	No	No
Graphics	Adreno 320	ARM Mali-T628 MP6	Adreno 330	Apple A7	192-core Kepler
Screen size	7in	8.4in	8in	7.9in	8.9in
Screen resolution	1920x1200	2560x1440	1920x1200	2048x1536	2048x1536
Pixel density	323ppi	359ppi	283ppi	326ppi	287ppi
Screen technology	IPS	Super AMOLED	IPS	IPS	IPS
Front camera	1.2Mp	2.1Mp	2.2Mp	1.2Mp	1.6Mp
Rear camera	5Mp	8Mp, LED flash	8.1Mp	5Mp	8Mp, LED flash
Video recording	1080p	1080p	1080p	1080p	1080p
Cellular connectivity	4G version available	4G version available	4G version available	4G version available	4G version available
Wi-Fi	802.11b/g/n, dual-band	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n, dual-band	802.11a/b/g/n/ac, dual-band
Bluetooth	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.1
GPS	GPS, Glonass	GPS, Glonass	A-GPS, Glonass	A-GPS, Glonass	GPS, Glonass
NFC	Yes	No	Yes	No	Yes
USB OTG	Yes	Yes	Yes	No	Yes
Fingerprint scanner	No	Yes	No	No	No
Waterproof	No	No	Yes	No	No
Extra features	None	Stereo speakers	PS4 Remote Play, stereo speakers	None	BoomSound speakers
Geekbench 3.0 (single)	Not tested	Not tested	Not tested	Not tested	1904
Geekbench 3.0 (multi)	Not tested	2765	2708	Not tested	3352
SunSpider	1136ms	1089ms	1017ms	397ms	955ms
GFXBench: T-Rex	Not tested	14fps	28fps	Not tested	48fps
GFXBench: Manhattan	Not tested	3fps	11fps	Not tested	22fps
Battery	3950mAh, non-removable, Qi	4900mAh, non-removable	4500mAh, non-removable	6470mAh, non-removable	6700mAh, non-removable
Dimensions	200x114x8.65mm	126x213x6.6mm	213x124x6.4mm	134.7x7.5x200mm	153.7x228.3x8mm
Weight	299g	294g	270g	331g	425g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/PUJDJBY	TINYURL.COM/OUEM64Z	TINYURL.COM/NJ6VHEO	TINYURL.COM/PCJPB5L	TINYURL.COM/NQ6K77Y

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Best 9- & 10in tablets











	Apple iPad Air 2	Samsung Galaxy Tab S 10.5	Sony Xperia Z2 Tablet	Apple iPad Air	Google Nexus 10
Price	**£399 inc VAT**	**£399 inc VAT**	**£369 inc VAT**	**£319 inc VAT**	**£389 inc VAT**
Website	Apple.com/uk	Samsung.com/uk	Sony.co.uk	Apple.com/uk	Play.google.com
Launch date	Oct 14	Aug 14	Mar 14	Oct 13	Oct 12
Build rating	★★★★★	★★★★☆	★★★★½	★★★★☆	★★★★½
Features rating	★★★★½	★★★★½	★★★★½	★★★★½	★★★★½
Performance rating	★★★★½	★★★★½	★★★★½	★★★★½	★★★★½
Value rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★½
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★½
OS (out of box)	iOS 8.2	Android 4.4 KitKat	Android 4.4 KitKat	iOS 8.2	Android 4.2 Jelly Bean
Processor	Apple A8X, Apple M8	Exynos 5420, octa-core	2.3GHz Snapdragon 801	Apple A7, Apple M7	1.7GHz Exynos 5250
RAM	2GB	3GB	3GB	1GB	2GB
Storage	16GB/64GB/128GB	16GB/32GB	16GB	16GB/32GB	16GB/32GB
MicroSD support	No	Up to 128GB	Up to 64GB	No	No
Graphics	Apple A8X	ARM Mali-T628 MP6	Adreno 330	Apple A7	ARM Mali T604
Screen size	9.7in	10.5in	10.1in	9.7in	10.1in
Screen resolution	2048x1536	2560x1600	1920x1200	2048x1536	2560x1600
Pixel density	264ppi	288ppi	224ppi	264ppi	300ppi
Screen technology	IPS	Super AMOLED	IPS	IPS	IPS
Front camera	1.2Mp	2.1Mp	2.2Mp	1.2Mp	1.9Mp
Rear camera	8Mp	8Mp, LED flash	8.1Mp	5Mp	5Mp, LED flash
Video recording	1080p	1080p	1080p	1080p	1080p
Cellular connectivity	4G version available	4G version available	4G version available	4G version available	No
Wi-Fi	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n/ac, dual-band	802.11a/b/g/n, dual-band	802.11b/g/n, dual-band
Bluetooth	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.0	Bluetooth 4.0
GPS	A-GPS, Glonass	GPS, Glonass	GPS, Glonass	A-GPS, Glonass	GPS, Glonass
NFC	Yes (for Apple Pay)	No	Yes	No	Yes
USB OTG	No	Yes	Yes	No	Yes
Fingerprint scanner	Yes	Yes	No	No	No
Waterproof	No	No	Yes	No	No
Extra features	None	Stereo speakers	PlayStation certified	None	None
Geekbench 3.0 (single)	1816	Not tested	967	1487	Not tested
Geekbench 3.0 (multi)	4523	2769	2719	2703	Not tested
SunSpider	Not tested	1079ms	1099ms	400ms	1329ms
GFXBench: T-Rex	48fps	14fps	27fps	23fps	Not tested
GFXBench: Manhattan	Not tested	3fps	Not tested	Not tested	Not tested
Battery	7340mAh, non-removable	7900mAh, non-removable	6000mAh, non-removable	8600mAh, non-removable	9000mAh, non-removable
Dimensions	240x169.5x6.1mm	247x177x6.6mm	266x172x6.4mm	240x169x7.5mm	264x178x8.9mm
Weight	437g	465g	439g	469g	603g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/PLQXWSZ	TINYURL.COM/OESDFZQ	TINYURL.COM/M8BZZUN	TINYURL.COM/NVOOF6H	TINYURL.COM/PUAG9RN

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Best smartwatches	1 PC ADVISOR RECOMMENDED	2 PC ADVISOR RECOMMENDED	3	4	5 PC ADVISOR RECOMMENDED
	LG G Watch R	Motorola Moto 360	Sony Smartwatch 3	Asus ZenWatch	LG G Watch
Price	£195 inc VAT	£199 inc VAT	£189 inc VAT	£199 inc VAT	£159 inc VAT
Website	Lg.com/uk	Motorola.co.uk	Sony.co.uk	Uk.asus.com	Lg.com/uk
Launch date	Nov 14	Oct 14	Sep 14	Jan 15	Jul 14
Overall rating	★★★★½	★★★★½	★★★½☆	★★★½☆	★★★★☆
Operating system	Android Wear	Android Wear	Android Wear	Android Wear	Android Wear
Compatibility	Android	Android	Android	Android	Android
Display	1.3in 320x320 P-OLED	1.56in 290x320 LCD	1.6in 320x320 LCD	1.6in 320x320 AMOLED	1.65in 280x280 IPS
Processor	1.2GHz Snapdrgon 400	TI OMAP 3	1.2GHz ARM V7	1.2GHz Snapdragon 400	1.2GHz Snapdragon 400
RAM	512MB	512MB	512MB	512MB	512MB
Storage	4GB	4GB	4GB	4GB	4GB
Waterproof	Yes	Yes	Yes	Yes	Yes
Battery	410mAh	320mAh	420mAh	1.4Wh	400mAh
Dimensions	46.4x53.6x9.7mm	46x11.5mm	36x51x10mm	51 x39.9x7.9-9.4mm	37.9x46.5x9.95mm
Weight	62g	49g (leather band model)	45g	75g	63g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/QATY8FT	TINYURL.COM/O9C69K6	TINYURL.COM/OQVZ3PN	TINYURL.COM/NN7GA7W	TINYURL.COM/Q84WL6L

Best smartwatches	6 PC ADVISOR RECOMMENDED	7 PC ADVISOR RECOMMENDED	8	9 PC ADVISOR RECOMMENDED	10
	Pebble Steel	Sony Smartwatch 2	Samsung Gear 2 Neo	Martian Notifier	Samsung Gear 2
Price	£179 inc VAT	£125 inc VAT	£169 inc VAT	£99 inc VAT	£260 inc VAT
Website	Getpebble.com	Sony.co.uk	Samsung.com/uk	Martianwatches.com	Samsung.com/uk
Launch date	Sep 14	Jun 13	Apr 14	Dec 14	Apr 14
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★½☆
Operating system	Proprietary	Proprietary	Tizen	Proprietary	Tizen
Compatibility	iOS, Android	Android	Samsung phones	iOS, Android	Samsung phones
Display	1.26in 144x168 E-Paper	1.6in 220x176 LCD	1.6in 320x320 Super AMOLED	1.01in 96x16 OLED	1.6in 320x320 Super AMOLED
Processor	Not specified	Not specified	Dual-core	Not specified	1GHz dual-core
RAM	512MB	Not specified	512MB	Not specified	512MB
Storage	Not specified	Not specified	4GB	Not specified	4GB
Waterproof	Yes	Yes	Yes	Yes	Yes
Battery	130mAh	Not specified	300mAh	Not specified	300mAh
Dimensions	46x34x10.5mm	42x41x9mm	58.8x37.9x10mm	43x43x12.7mm	36.9x58.4x10mm
Weight	156g	123g	55g	52g	68g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/PPBXV7J	TINYURL.COM/P4X7AZM	TINYURL.COM/Q68FS5U	TINYURL.COM/NS9E8GK	TINYURL.COM/QXCZ8J3

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Best activity trackers











	Fitbit Charge HR	Fitbit Surge	Fitbit One	Microsoft Band	Fitbit Charge
Price	**£119 inc VAT**	**£199 inc VAT**	**£79 inc VAT**	**£169 inc VAT**	**£99 inc VAT**
Website	Fitbit.com/uk	Fitbit.com/uk	Fitbit.com/uk	Microsoft.com/en-gb	Fitbit.com/uk
Launch date	Jan 15	Jan 15	Jan 14	May 15	Nov 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★½☆	★★★★☆
Compatibility	iOS, Android, Windows	iOS, Android, Windows	iOS, Android	iOS, Android, Windows	iOS, Android, Windows
Display	OLED	Touchscreen	OLED	TFT	OLED
Pedometer	Yes	Yes	Yes	Yes	Yes
Heart-rate monitor	Yes	Yes	No	Yes	No
Sleep tracking	Yes	Yes	Yes	Yes	Yes
Alarm	Yes	Yes	Yes	Yes	Yes
Third-party app synching	Yes	Yes	Yes	Yes	Yes
Call notifications	Yes	Yes	No	Yes	Yes
Waterproof	Yes	Yes	No	Yes	Yes
Battery life	5+ days	5 days	10-14 days	2 days	7-10 days
Dimensions, weight	21.1mm, 26g	34mm, 51g	35.5x28x9.65mm, 8g	11x33mm, 60g	21.1mm, 24g
FULL REVIEW	TINYURL.COM/PCKV4SU	TINYURL.COM/O83DR47	TINYURL.COM/PT2TC6F	TINYURL.COM/LHMQ2AC	TINYURL.COM/PFMQ9KH

Best activity trackers











	Basis Peak	Xiaomi Mi Band	Jawbone Up 2	Jawbone Up Move	Jawbone Up24
Price	**£169 inc VAT**	**£29 inc VAT**	**£89 inc VAT**	**£39 inc VAT**	**£99 inc VAT**
Website	En-gb.mybasis.com	Mobilefun.co.uk	Jawbone.com	Jawbone.com	Jawbone.com
Launch date	Apr 15	Feb 15	June 15	Nov 14	Mar 14
Overall rating	★★★½☆	★★★★½	★★★★☆	★★★★☆	★★★½☆
Compatibility	iOS, Android	iOS, Android	iOS, Android	iOS, Android	iOS, Android
Display	E-Ink	No	No	No	No
Pedometer	Yes	Yes	Yes	Yes	Yes
Heart-rate monitor	Yes	No	No	No	No
Sleep tracking	Yes	Yes	Yes	Yes	Yes
Alarm	No	Yes	Yes	No	Yes
Third-party app synching	No	No	Yes	Yes	Yes
Call notifications	Yes	Yes	No	No	No
Waterproof	Yes	Yes	Splashproof	Splashproof	Splashproof
Battery life	4 days	30 days	7 days	Six months, non-rechargable	7 days
Dimensions, weight	33x43x10mm, 51g	157-205mm, 13g	220x11.5x3-8.5mm, 25g	27.6x27.6x9.8mm, 6.8g	S: 19g, M: 22g, L: 23g
FULL REVIEW	TINYURL.COM/LHMQ2AC	TINYURL.COM/QZ3YVCR	TINYURL.COM/PHT98ZK	TINYURL.COM/PFXQFNE	TINYURL.COM/ND8YMB8

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Best budget printers

	1	2	3	4	5
		 PC ADVISOR RECOMMENDED	 PC ADVISOR GOLD		
	Samsung Xpress M2070W	**Canon Pixma MG5550**	**Canon i-Sensys LBP6230dw**	**Samsung Xpress M2022W**	**Canon Pixma MX535**
Price	**£100 inc VAT**	**£60 inc VAT**	**£91 inc VAT**	**£68 inc VAT**	**£70 inc VAT**
Website	Samsung.com/uk	Canon.co.uk	Canon.co.uk	Samsung.com/uk	Canon.co.uk
Launch date	Mar 14	Apr 14	Mar 15	Aug 14	Jul 14
Overall rating	★★★★½	★★★★☆	★★★★½	★★★★☆	★★★★☆
Technology	Mono laser	Colour inkjet	Mono laser	Mono laser	Colour inkjet
Max print resolution	1200x1200	4800x1200dpi	1200x1200dpi	1200x1200dpi	4800x1200dpi
Actual print speed	B=17.1ppm	B=11.8ppm C=8.7ppm	B=22.2ppm	B=18ppm	B=9.7ppm C=3.8ppm
Scan/fax facilities	1200x1200 scans	1200x2400 scans	None	None	1200x2400 scans/fax
Supported interfaces	USB 2.0, 802.11b/g/n, NFC	USB 2.0, 802.11b/g/n	USB 2.0, 802.11b/g/n	USB 2.0, 802.11b/g/n	USB 2.0, 802.11b/g/n, AirPrint
Cost per page	B=3.8p	B=2.4p C=4.8p	B=2p	B=5p	B=2.7p C=4.8p
Media card/auto duplex	××	×✓	×✓	××	×✓
Input capacity	150 sheets	100 sheets	250 sheets	150 sheets	100 sheets + 30-sheet ADF
Dimensions	406x360x253mm	455x369x148mm	379x293x243mm	332x215x178mm	458x385x200mm
Weight	7.4kg	6.3kg	7kg	4kg	8.5kg
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/OYZKJKE	TINYURL.COM/LKWLJDE	TINYURL.COM/KZW8VU3	TINYURL.COM/NFJHDOR	TINYURL.COM/N9LXVN7

Best printers

	1	2	3	4	5
	 PC ADVISOR GOLD				 PC ADVISOR GOLD
	Epson WorkForce Pro	**Canon i-Sensys MF6180dw**	**Epson Ecotank L555**	**Brother HL-L9200CDWT**	**HP OfficeJet Pro X551dw**
Price	**£200 inc VAT**	**£320 inc VAT**	**£330 inc VAT**	**£548 inc VAT**	**£275 inc VAT**
Website	Epson.co.uk	Canon.co.uk	Epson.co.uk	Brother.co.uk	Hp.com/uk
Launch date	May 15	May 14	Jan 15	Aug 14	Aug 13
Overall rating	★★★★½	★★★★½	★★★★☆	★★★★½	★★★★½
Technology	Colour inkjet	Mono laser	Colour inkjet	Colour laser	Colour inkjet
Max print resolution	4800x1200dpi	1200x600dpi	5760x1440dpi	2400x600dpi	2400x2400
Actual print speed	B=18.9ppm	B=24ppm	B=8.5ppm C=4ppm	B=30ppm C=30ppm	B=42.9ppm C=15.8ppm
Scan/fax facilities	None	600dpi scanner, 33.6Kb/s fax	1200dpi scanner, 33.6Kb/s fax	None	None
Supported interfaces	USB 2.0, ethernet, 802.11b/g/n	USB 2.0, ethernet, 802.11b/g/n	USB 2.0, 802.11b/g/n	USB 2.0, ethernet, 802.11b/g/n	USB 2.0, ethernet, 802.11b/g/n
Cost per page	B=1.1p	B=1.5p	B=0.2p C=0.4p	B=1p C=5.9p	B=1p C=4.3p
Media card/auto duplex	×✓	×✓	××	×✓	×✓
Input capacity	250 + 80 sheet	250 + 50 sheet + 50 ADF	100 + 30 sheet	750 sheets + 50 sheet	500 + 50 sheet
Dimensions	3461x442x284mm	390x473x431mm	474x377x226mm	410x495x445mm	517x399x414mm
Weight	11.4kg	19.1kg	6.2kg	28.3kg	17.1kg
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/OC7FUJ3	TINYURL.COM/LE9WA5N	TINYURL.COM/N8NS5QL	TINYURL.COM/PT52MH6	TINYURL.COM/CZO5P65

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Best wireless routers











	Apple AirPort Extreme	Netgear Nighthawk R7000	D-Link DIR 880L	TP-Link Archer C7	Asus RT-AC68U AC1900
Price	**£169 inc VAT**	**£150 inc VAT**	**£108 inc VAT**	**£90 inc VAT**	**£160 inc VAT**
Website	Apple.com/uk	Netgear.co.uk	Dlink.com	Tp-link.com	Uk.asus.com
Launch date	Jan 14	Sep 14	Sep 14	Jan 14	Jan 14
Overall rating	★★★★☆	★★★★½	★★★★☆	★★★★☆	★★★★☆
Standards supported	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n/ac	802.11a/b/g/n/ac
Frequency modes	2.4GHz/5GHz (concurrent)	2.4GHz/5GHz (concurrent)	2.4GHz/5GHz (concurrent)	2.4GHz/5GHz (concurrent)	2.4GHz/5GHz (concurrent)
Antennas	6x internal	3x external	3x external	3x external, 3x internal	3x external, 3x internal
Built-in modem	×	×	×	×	×
Manufacturer's rating	1300/450Mb/s	1300/600Mb/s	1300/600Mb/s	1300/450Mb/s	1300/600Mb/s
WPS	×	✓	✓	✓	✓
Ports	Gigabit WAN, 3x gigabit LAN, USB	Gigabit WAN, 1x USB 3.0, 1x USB 2.0	Gigabit WAN, 1x USB 3.0, 1x USB 2.0	Gigabit WAN, 4x gigabit LAN, 2x USB 2.0	Gigabit WAN, 4x gigabit LAN, 2x USB 2.0
Average power use	8W	9W	10W	N/A	N/A
Max speed (11n/11ac)	171/572Mb/s	171/592Mb/s	171/625Mb/s	110/505Mb/s	98/610Mb/s
Dimensions, weight	98x168x98mm, 945g	285x186x45mm, 750g	247x190x47mm, 745g	32.5x243x160mm, 508g	160x83x220mm, 640g
Warranty	1 year	N/S	N/S	3 years	2 years
FULL REVIEW	TINYURL.COM/MFDLLSC	TINYURL.COM/Q2NRQ8Q	TINYURL.COM/OZ5G7KG	TINYURL.COM/KKJMPCE	TINYURL.COM/K4ZATKV

Best powerline adaptors











	Solwise SmartLink 1200AV2	TrendNet Powerline 500 AV2	Devolo dLan 1200+	TP-Link AV1200	TP-Link TL-WPA4230P
Price	**£43 inc VAT**	**£41 inc VAT**	**£119 inc VAT**	**£88 inc VAT**	**£88 inc VAT**
Website	Solwise.com	Trendnet.com	Devolo.com/uk	Uk.tp-link.com	Uk.tp-link.com
Launch date	Nov 14	Mar 14	Sep 14	May 15	Apr 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★☆
No of adaptors in kit	1 (2 required)	2	2	2	2
Max throughput	1200Mb/s	600Mb/s	1200Mb/s	1200Mb/s	500Mb/s
Near test result	410Mb/s	146Mb/s	357Mb/s	500Mb/s	100Mb/s
Far test result	107Mb/s	71Mb/s	126Mb/s	200Mb/s	65Mb/s
Ethernet ports	2x gigabit	1x gigabit	1x gigabit	1x gigabit	3x fast
Passthrough socket	Yes	No	Yes	Yes	Yes
Wireless hotspot	No	No	No	No	Yes
Encryption	128-bit	128-bit	128-bit	128-bit	128-bit
Dimensions	62x122x41mm	55x87x58mm	130x66x42mm	230x190x100mm	126x64x42mm
Weight	Not specified	90g	Not specified	898g	Not specified
Warranty	2 years	3 years	3 years	1 year	1 year
FULL REVIEW	TINYURL.COM/NZ4EJW8	TINYURL.COM/QYEPJQ7	TINYURL.COM/Q4EOO4M	TINYURL.COM/NVONCWT	TINYURL.COM/NKWAVP9

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Best NAS drives



	Qnap TS-421	Synology DS115j	Qnap HS-210	WD My Cloud EX2100	Synology DS414j
Price	**£320 inc VAT (diskless)**	**£83 inc VAT (diskless)**	**£190 inc VAT (diskless)**	**£205 inc VAT (diskless)**	**£270 inc VAT (diskless)**
Website	Qnap.com	Synology.com	Qnap.com	Wd.com	Synology.com
Launch date	Mar 14	Feb 15	Dec 14	May 15	Jan 15
Overall rating	★★★★☆	★★★★☆	★★★★½	★★★★☆	★★★★☆
Drive bays	4	1	2	2	4
Processor	2GHz Marvell single-core	800MHz Marvell Armada 370	1.6GHz Marvell single-core	1.3 GHz Marvel Armada 385	1.2GHz Mindspeed Concerto
Memory	1GB DDR3	256MB DDR3	512MB DDR3	1GB DDR3	512MB DDR3
Remote access	✓	✓	✓	✓	✓
eSATA	2x	×	×	×	1x
USB port	2x USB 3.0, 2x USB 2.0	2x USB 2.0	2x USB 3.0, 2x USB 2.0	2x USB 3.0	1x USB 3.0, 1x USB 2.0
Raid options	0/1/5/6/10/JBOD	None	0/1/JBOD	00/1/JBOD	0/1/5/6/10/JBOD
Software	Backup Station	DSM 5.1	HD Station	My Cloud	DSM 5.0
Dimensions	177x180x235mm	71x161x224mm	302x220x41mm	216x109x148mm	184x168x230mm
Weight	3kg	700g	1.5kg	3.5kg	2.2kg
Warranty	2 years	1 year	2 years	3 years	3 years
FULL REVIEW	TINYURL.COM/MCYWUB8	TINYURL.COM/MNEYVNK	TINYURL.COM/OEXRYNY	TINYURL.COM/M643BSG	TINYURL.COM/M643BSG

Best external hard drives



	Transcend StoreJet 25M3	Toshiba Canvio Basics	WD My Passport Ultra Metal	Seagate Seven mm	iStorage diskAshur Pro
Price	**£70 inc VAT**	**£76 inc VAT**	**£90 inc VAT**	**£99 inc VAT**	**£269 inc VAT**
Website	Uk.transcend-info.com	Toshiba.co.uk	Wdc.com/en	Seagate.com/gb/en	Istorage-uk.com
Launch date	Feb 15	Feb 15	Feb 15	Feb 15	Feb 15
Overall rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★½☆
Capacity tested	2TB	2TB	2TB	500GB	1TB
Capacity range	500GB, 1TB, 2TB	500GB, 1TB, 2TB	1TB, 2TB	500GB	500GB, 1TB, 1.5TB, 2TB
Disk size	2.5in	2.5in	2.5in	2.5in	2.5in
Spin speed	5400rpm	5400rpm	N/A	5400rpm	5400rpm
Transfer speed	135MB/s	117MB/s	114MB/s	49MB/s	115MB/s
Encryption	256-bit AES	256-bit AES	256-bit AES	N/A	256bit AES-XTS
Other interfaces	USB 3.0	USB 3.0	USB 3.0	USB 3.0	USB 3.0
Software	Transcend Elite	None	WD Drive Utilities	Seagate Dashboard	Security utilities
Dimensions	130x82x19mm	111x79x21mm	110x80x19mm	123x82x7mm	120x85x20mm
Weight	234g	207g	241g	178g	200g
Warranty	3 years	2 years	3 years	2 years	2 years
FULL REVIEW	TINYURL.COM/M72D3EP	TINYURL.COM/JWHHACB	TINYURL.COM/L2B7V3B	TINYURL.COM/O6KZFDM	TINYURL.COM/MZOBZ6J

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Best SSDs











	Crucial M550	OCZ Vector 150	Crucial M500	Samsung 840 EVO	Seagate 600 SSD
Price	**£338 inc VAT**	**£125 inc VAT**	**£155 inc VAT**	**£320 inc VAT**	**£202 inc VAT**
Website	Crucial.com/uk	Ocz.com	Crucial.com/uk	Samsung.com/uk	Seagate.com/gb
Launch date	May 14	May 14	Aug 13	Nov 13	May 14
Overall rating	★★★★½	★★★★☆	★★★★½	★★★★½	★★★★☆
Capacity tested	1TB	240GB	480GB	750GB	480GB
Price per GB	34p	52p	32p	43p	43p
Memory cache	1GB LP DDR2	512MB	512MB DDR3	1GB LPDDR2	N/A
Controller	Marvell 88SS9189	Indilinx Barefoot 3 M00	Marvell 88SS9187	Samsung MEX (3-core ARM)	Link A Media Device
Encryption	AES 256-bit	AES 256-bit	AES 256-bit	AES 256-bit	None
Flash	Micron 20nm MLC NAND	Toshiba 19nm MLC	Micron 20nm MLC NAND	Samsung 19nm Toggle NAND	Toshiba 19nm MLC
Firmware updated via	Bootable CD	OCZ Toolbox, bootable	ISO boot disc	SSD Magician for Windows	Seagate Firmware, bootable
ATTO peak sequential	R: 563MB/s; W: 514MB/s	R: 557MB/s; W: 534MB/s	R: 539MB/s; W: 433MB/s	R: 554MB/s; W: 537MB/s	R: 555MB/s; W: 474MB/s
CDM peak IOPS	100 / 91.7	92.9 / 94.7	89.8k (read)	104K (read)	96.8 / 88.6
CDM 4kB rnd	30/99	25/97	N/A	N/A	28/78
Warranty	3 years	5 years or 91TB writes	3 years	5 years	3 years
FULL REVIEW	TINYURL.COM/MSWD98Z	TINYURL.COM/KBED2W6	TINYURL.COM/M2NCSMJ	TINYURL.COM/L5EDQOY	TINYURL.COM/N58RB8G

Best projectors











	ViewSonic PLED-W800	BenQ W1300	Optoma W316	InFocus IN126STa	NEC M352WS
Price	**£512 inc VAT**	**£730 inc VAT**	**£458 inc VAT**	**£525 inc VAT**	**£778 inc VAT**
Website	Viewsoniceurope.com/uk	Benq.co.uk	Optoma.co.uk	Infocus.com	Nec-display-solutions.com
Launch date	Feb 15	Jun 14	Jul 14	Sep 14	Jul 14
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Projection technology	DLP	DLP	DLP	DLP	DLP
Resolution (pixels)	1280x800	1920x1080	1280x800	1280x800	1280x800
Brightness, Contrast	800, 120,000:1	2000, 10,000:1	3400, 15,000:1	3300, 15,000:1	3500, 10,000:1
Image size	100in	300in	300in	300in	150in
Supported aspect ratios	16:10 native	16:9 native	16:10, 16:9, 4:3	16:10, 16:9, 4:3	16:10
Noise levels (dB)	34 (32 eco)	33 (30 eco)	29db	32db (30 eco)	33 (39 bright mode)
Connections	VGA, HDMI, USB	VGA, 2x HDMI, USB, 3D	VGA, HDMI, Mini-USB, 3D	2x VGA, HDMI, USB, ethernet	2x VGA, 2x HDMI, USB
Lamp/lamp life	90W/30000 hrs	240W/6000 hrs	190W/10000 hrs	278W/3500 hrs	278W/8000 hrs
Dimensions	175x52x138mm	330x257x128mm	315x223x102mm	292x220x108mm	368x268x97mm
Weight	0.83kg	3.4kg	2.5kg	3.7kg	3.6kg
Warranty	3 years	3 years	2 years	1 year	3 years
FULL REVIEW	TINYURL.COM/K83X8LA	TINYURL.COM/K4FA89Q	TINYURL.COM/OCWTHGW	TINYURL.COM/NHH3QPB	TINYURL.COM/Q6J2N6W

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Best budget graphics cards











	MSI Radeon R9 270X	MSI Radeon R9 270 Gaming Ed	MSI R7 260X OC	XFX Radeon R7-265	Gigabyte GTX 750 Ti
Price	**£130 inc VAT**	**£125 inc VAT**	**£91 inc VAT**	**£110 inc VAT**	**£120 inc VAT**
Website	Uk.msi.com	Uk.msi.com	Uk.msi.com	Sapphiretech.com	Uk.gigabyte.com
Launch date	Dec 13	Jul 14	May 14	Sep 14	Aug 14
Overall rating	★★★★☆	★★★★½	★★★½☆	★★★★☆	★★★½☆
Graphics processor	AMD Radeon R9 270X	AMD Radeon R9 270	AMD Radeon R7 260X	AMD Radeon R7 265	nVidia GeForce GTX 750 Ti
Installed RAM	2GB GDDR5	2GB GDDR5	2GB GDDR5	2GB GDDR5	2GB GDDR5
Memory interface	256-bit	256-bit	128-bit	128-bit	128-bit
Core clock/boost	1030MHz/1120MHz	900MHz/975MHz	1175MHz/none	900MHz/925MHz	1033MHz/1111MHz
Memory clock/Effective	1.4/5.6GHz	1.4/5.6GHz	1625MHz/6.5GHz	1.4/5.6GHz	1.35/5.4GHz
Stream processors	1280	1280	896	Varies	640
Texture units	80	80	56	64	40
Power connectors	2x 6-pin	1x 6-pin	1x 6-pin	1x 6-pin	N/A
DirectX	11	11.2	11.1	11	11.2
Digital interface	2x DVI, HDMI, DisplayPort	2x DVI, HDMI, DP	2x DVI, HDMI, Mini-DP	2x DVI, 1x HDMI, 1x DP	2x DVI, 2x HDMI
Warranty	2 years	3 years	3 years	2 years	3 years
FULL REVIEW	TINYURL.COM/OYA2DFJ	TINYURL.COM/MCE7353	TINYURL.COM/OZ6WUYT	TINYURL.COM/LV69BEM	TINYURL.COM/Q7K4ESV

Best graphics cards











	Gigabyte GeForce GTX 770 2GB	Sapphire Radeon R9 280X	XFX Radeon R9 290X	Zotac Geforce GTX 960	MSI Radeon R9 295 X2
Price	**£200 inc VAT**	**£200 inc VAT**	**£280 inc VAT**	**£285 inc VAT**	**£680 inc VAT**
Website	Uk.gigabyte.com	Sapphiretech.com	Xfxforce.com	Zotac.com	Uk.msi.com
Launch date	Aug 13	Mar 14	Apr 14	Mar 15	May 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★☆
Graphics processor	nVidia GeForce GTX 770	AMD Radeon R9 280X	AMD Radeon R9 290X	nVidia GeForce GTX 960	AMD Radeon R9 295 X2
Installed RAM	2GB GDDR5	3GB GDDR5	4GB GDDR5	2GB GDDR5	8GB GDDR5
Memory interface	256-bit	384-bit	512-bit	128-bit	2x 512-bit
Core clock/boost	950/1020MHz	950/1070MHz	1/1GHz	1266/1329MHz	1018MHz/N/A
Memory clock/Effective	1.5GHz/6GHz	1.55GHz/6.2GHz	1.25GHz/5GHz	1752MHz/7.1GHz	1.25GHz/5GHz
Stream processors	1536	2048	2816	1024	2x 2816
Texture units	128	128	176	64	2x 176
Power connectors	1x 6-pin, 1x 8-pin	2x 8-pin	8-pin, 6-pin	1x 6-pin	2x 8-pin
DirectX	11	11	11	12	11
Digital interface	2x DVI, HDMI, DisplayPort	DVI, HDMI, 2x Mini-DisplayPort	2x DVI, HDMI, DisplayPort	DVI, HDMI, 3x DisplayPort	DVI, 4x Mini-DP
Warranty	3 years	2 years	3 years	5 years	3 years
FULL REVIEW	TINYURL.COM/OAG6277	TINYURL.COM/OWVAP37	TINYURL.COM/NPET8ER	TINYURL.COM/MWBCO36	TINYURL.COM/POTAOGZ

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Best budget flat-panel displays



	AOC i2369Vm	Philips 234E5QHAW	NEC MultiSync E243WMi	BenQ EW2740L	BenQ GL2450
Price	**£130 inc VAT**	**£130 inc VAT**	**£194 inc VAT**	**£175 inc VAT**	**£108 inc VAT**
Website	Aoc-europe.com/en	Philips.co.uk	Nec-display-solutions.com	Benq.co.uk	Benq.co.uk
Launch date	Jul 14	Jul 14	Jun 14	Aug 14	Jul 14
Overall rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Screen size	23in	23in	23.8in	27in	24in
Panel type	IPS matt	IPS matt	IPS matt	VA semi-matt	TN matt
Native resolution	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080
Pixel density	96ppi	96ppi	93ppi	82ppi	92ppi
Brightness	220cd/m²	187cd/m²	250cd/m²	300cd/m²	261cd/m²
Static contrast ratio	630:1	210:1	650:1	280:1	610:1
Response time	6ms	5ms	6ms	4ms	5ms
Ports	HDMI, HDMI/MHL, DP, VGA	2x HDMI (QHAB) or 1x HDMI (QDAB), VGA	DP, DVI-D, VGA	2x HDMI, VGA	DVI-D, VGA
Dimensions	531x204x398mm	532x213x414mm	558x214x380-490mm	623x191x451mm	579x179x436mm
Weight	3.75kg	3.5kg	6.3kg	4.2kg	4.1kg
Warranty	3 years	2 years	3 years	2 years	2 years
FULL REVIEW	TINYURL.COM/OOEFYPR	TINYURL.COM/KLYLW4V	TINYURL.COM/KNCGVOU	TINYURL.COM/OO6EC5L	TINYURL.COM/OOUPFUE

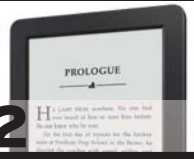
Best flat-panel displays



	LG 34UM95	HP DreamColor Z27x	Dell UltraSharp 32 Ultra	BenQ PG2401PT	ViewSonic VP2772
Price	**£760 inc VAT**	**£750 inc VAT**	**£1,455 inc VAT**	**£855 inc VAT**	**£540 inc VAT**
Website	Lg.com/uk	hp.com/uk	Dell.co.uk	Benq.co.uk	Viewsoniceurope.com/uk
Launch date	Dec 14	Jan 15	Jun 14	Oct 14	Jun 14
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★½☆
Screen size	34in 21:9	27in	31.5in	24.1in	27in
Panel type	IPS matt	AH-IPS	IGZO	IPS	AH-IPS
Native resolution	3440x1440	2560x1440	3840x2160	1920x1200	2560x1440
Pixel density	110ppi	109ppi	140ppi	94ppi	109ppi
Brightness	320cd/m²	250cd/m²	350cd/m²	317cd/m²	350cd/m²
Static contrast ratio	1000:1	800:1	550:1	540:1	560:1
Response time	5ms	7ms	8ms	5ms	6ms
Ports	HDMI, DP, Thunderbolt, USB 3.0	HDMI, DP, USB 3.0, USB 2.0	HDMI, DP, Mini-DP, 4x USB 3.0	DVI, DP, HDMI, VGA, 3x USB 3.0	HDMI, DVI, Mini-DP, 4x USB 3.0
Dimensions	830x83x380mm	641x655x379mm	750x214x483-572mm	543x254x555mm	643x348x470mm
Weight	6.7kg	8.8kg	9.2kg	7kg	8.5kg
Warranty	2 years	3 years	3 years	1 year	3 years
FULL REVIEW	TINYURL.COM/QYKH6UM	TINYURL.COM/NKUF9EN	TINYURL.COM/O4CTO3S	TINYURL.COM/PMV5L5V	TINYURL.COM/LLQRWTX

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Best e-book readers

	1	2	3	4	5
					
	Amazon Kindle Voyage	**Amazon Kindle (7th gen)**	**Amazon Kindle Paperwhite**	**Nook GlowLight**	**Kobo Aura H20**
Price	**£169 inc VAT**	**£59 inc VAT**	**£109 inc VAT**	**£89 inc VAT**	**£139 inc VAT**
Website	Amazon.co.uk	Amazon.co.uk	Amazon.co.uk	Nook.com/gb	Kobo.com
Launch date	Oct 14	Sep 14	Sep 13	Oct 13	Sep 14
Overall rating	★★★★☆	★★★½☆	★★★★☆	★★★★☆	★★★☆☆
Screen size	6in touchscreen	6in touchscreen	6in touchscreen	6in touchscreen	6.8in touchscreen
Screen technology	E Ink	E Ink	E Ink	E Ink	E Ink
Screen resolution	1440x1080	600x800	768x1024	758x1024	1430x1080
Built-in light	Yes	No	Yes	Yes	Yes
Storage	4GB	4GB	2GB	4GB	4GB, microSD up to 32GB
Book store	Amazon Kindle	Amazon Kindle	Amazon Kindle	Nook	Kobo
Cellular connectivity	Optional extra	No	Optional extra	No	No
Battery life	Six weeks	Four weeks	Eight weeks	Eight weeks	Two months
Dimensions	162x115x7.6mm	169x119x10.2mm	117x169x9.1mm	127x166x10.7mm	179x129x9.7mm
Weight	180g	191g	206g	175g	233g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/NXAAU3Q	TINYURL.COM/NSFORJE	TINYURL.COM/PREZPRK	TINYURL.COM/OZ5WMPO	TINYURL.COM/MJVR4M9

Best media streamers

	1	2	3	4	5
					
	Roku Streaming Stick	**Roku 3**	**Google Chromecast**	**Apple TV**	**Amazon Fire TV**
Price	**£49 inc VAT**	**£99 inc VAT**	**£30 inc VAT**	**£59 inc VAT**	**£79 inc VAT**
Website	Roku.com	Roku.com	Play.google.com	Apple.com/uk	Amazon.co.uk
Launch date	Mar 14	Mar 13	Mar 14	Mar 12	Oct 14
Overall rating	★★★★½	★★★★☆	★★★★☆	★★★★☆	★★★★☆
Type	Dongle	Set-top box	Dongle	Set-top box	Set-top box
Ports	HDMI, Micro-USB	HDMI, USB, ethernet	HDMI, Micro-USB	HDMI, ethernet, Micro-USB	HDMI, USB, ethernet
Processor	600MHz single-core	900MHzsingle-core	Single-core	Apple A5 single-core	1.7GHz Qualcomm quad-core
RAM	512MB	512MB	512MB	512MB	2GB
Graphics	Not specified	Not specified	Not specified	Not specified	Adreno 320
Storage	None	512MB plus microSD slot	None	8GB (not user-accessible)	8GB
Voice search	No	Yes	No	No	Yes
Remote control	Yes	Yes	No	Yes	Yes
Dimensions	78.7x27.9x12.7mm	89x89x25mm	72x35x12mm	98x98x23mm	115x115x17.5mm
Weight	18g	170g	34g	270g	281g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/OAP9QF9	TINYURL.COM/PT7MGUL	TINYURL.COM/QBGTCS2	TINYURL.COM/OLCJRC3	TINYURL.COM/P4RE7WP

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Best games consoles



	Sony PlayStation 4	Microsoft Xbox One	Nintendo Wii U Premium	Sony PlayStation 3 Super Slim	Microsoft Xbox 360
Price	**£349 inc VAT**	**£349 inc VAT**	**£249 inc VAT**	**£249 inc VAT**	**£199 inc VAT**
Website	Playstation.com	Xbox.com	Nintendo.co.uk	Playstation .com	Xbox.com
Launch date	Nov 13	Nov 13	Nov 12	Sep 12	Dec 05
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★½	★★★★★
Processor	Octa-core AMD x86	1.75GHz octa-core AMD x86	IBM Power multicore CPU	IBM CPU	IBM Xenon CPU
Graphics	1.84TFlops AMD Radeon GPU	1.31TFlops AMD Radeon GPU	AMD Radeon GPU	256MB nVidia RSX	512MB ATI Xenos
RAM	8GB GDDR5	8GB DDR3	Not specified	Not specified	512MB GDDR3
Storage	500GB	500GB	32GB, plus SD card support	500GB	500GB
Optical drive	Blu-ray, DVD, game discs	Blu-ray, DVD, game discs	Wii U, Wii discs only	Blu-ray, DVD, game discs	DVD, game discs
Ports	2x USB 3.0, AUX, HDMI	USB 3.0, HDMI	4x USB 2.0, HDMI	2x USB 2.0, HDMI	5x USB, HDMI
Connectivity	Ethernet, 802.11b/g/n, Bluetooth	Ethernet, 802.11b/g/n	802.11b/g/n	Ethernet, 802.11b/g/n, Bluetooth	Ethernet, 802.11b/g/n
Other	1 controller	1 controller, 4K, Kinect option	1 controller	1 controller	1 controller
Dimensions	275x53x305mm	333x274x79mm	46x269x171mm	290x230x60mm	269x75x264mm
Weight	2.8kg	3.2kg	1.6kg	2.1kg	2.9kg
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/NBFLQK2	TINYURL.COM/M6J4KHS	TINYURL.COM/6J49LHL	TINYURL.COM/QDJP56O	TINYURL.COM/PFP9CCK

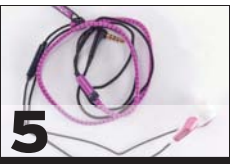
Best budget portable speakers



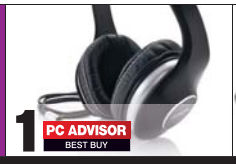
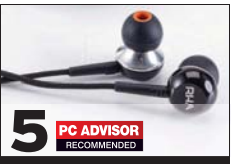
	Lumsing B9	i-box Twist	Lava BrightSounds	Denon Envaya Mini	iClever IC-BTS02
Price	**£23 inc VAT**	**£41 inc VAT**	**£39 inc VAT**	**£99 inc VAT**	**£23 inc VAT**
Website	Lumsing.com	Iboxstyle.com	Lavaaccessories.co.uk	Denon.com	Hisgadget.com
Launch date	Aug 14	Nov 12	Dec 14	Jan 15	Nov 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★★½	★★★★☆
Speaker(s)	2x 3W	2x 3W	1x 5W	Not specified	1x 5W
Bluetooth	Bluetooth 3.0 + EDR	Bluetooth 2.1	Not specified	Bluetooth 4.0	Bluetooth 4.0
Handsfree calls	Yes	Yes	Yes	Yes	Yes
NFC	Yes	No	No	Yes	No
Frequency response	20Hz to 20kHz	Not specified	Not specified	Not specified	90Hz to 18kHz
Impedence	4 ohms	Not specified	Not specified	Not specified	Not specified
Extra features	MicroSD slot, lanyard	None	IPX4 splashproof, LED lamp	IPX4 splashproof	None
Claimed battery life	25 hours	5 hours	8 hours	10 hours	8-12 hours
Dimensions	177x50x70mm	246x59x56mm	190x95x103mm	209x54x51mmmm	64.5x64.5x70.1mm
Weight	300g	380g	821g	558g	261g
Warranty	1 year	5 years	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/P623MK8	TINYURL.COM/LET9RDF	TINYURL.COM/KOM2ZT3	TINYURL.COM/QDRNP3P	TINYURL.COM/Q2YT6NV

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Best budget headphones

	1 PC ADVISOR RECOMMENDED	2 PC ADVISOR RECOMMENDED	3 PC ADVISOR RECOMMENDED	4 PC ADVISOR RECOMMENDED	5
					
	RHA MA450i	**Sennheiser HD 429**	**Rock Jaw Alpha Genus**	**AKG K77**	**Vibe Slick Zip V3**
Price	**£39 inc VAT**	**£45 inc VAT**	**£41 inc VAT**	**£25 inc VAT**	**£12 inc VAT**
Website	Rha-audio.com/uk	En-uk.sennheiser.com	Rockjawaudio.com	Uk.akg.com	Vibeaudio.co.uk
Launch date	Nov 14	Jan 11	Jun 14	May 08	Sep 13
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★½☆
Type	In-ear	Circumaural over-ear	In-ear	Circumaural over-ear	In-ear
Frequency response	16Hz to 22kHz	18Hz to 22kHz	20Hz to 20kHz	18Hz to 20.5kHz	20Hz to 20kHz
Nominal impedence	16 ohms	32 ohms	16 ohms	32 ohms	16 ohms
Sensitivity	103dB	110dB	108dB	112dB	93dB
In-line remote	Yes (3 button)	No	No	No	Yes (1 button)
Mic	Yes	No	No	No	Yes
Extra grommets	Yes	N/A	Yes, and filters	N/A	Yes
Carry case	Yes	No	Yes	No	No
Cable length	1.5m (braided)	3m	1.2m (twisted)	2.5m	1.2m
Weight	14g	218g	11g	190g	21g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/P7W7RVL	TINYURL.COM/ND8TD8O	TINYURL.COM/NNYUFBF	TINYURL.COM/PA8FOX4	TINYURL.COM/QJULK9P

Best headphones

	1 PC ADVISOR BEST BUY	2 PC ADVISOR RECOMMENDED	3	4 PC ADVISOR RECOMMENDED	5 PC ADVISOR RECOMMENDED
					
	Denon AH-D600	**Bose QC20**	**Denon AH-W150**	**Bowers & Wilkins P3**	**RHA MA450i**
Price	**£229 inc VAT**	**£259 inc VAT**	**£59 inc VAT**	**£169 inc VAT**	**£39 inc VAT**
Website	Denon.co.uk	Bose.co.uk	Denon.co.uk	Bowers-wilkins.co.uk	Rha-audio.com/uk
Launch date	Aug 2012	Jun 13	Aug 12	Jun 12	Nov 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★★½	★★★★½
Type	Circumaural over-ear	In-ear	Over-ear wireless buds	On-ear, foldable	In-ear
Frequency response	8Hz to 25kHz	20-21kHz	5Hz to 25kHz	10Hz to 20kHz	16Hz to 22kHz
Nominal impedence	37 ohms	32 ohms	16 ohms	34 ohms	16 ohms
Sensitivity	120dB	105dB	102dB	111dB	103dB
In-line remote	Yes	Yes	Yes	Yes	Yes (3 button)
Mic	No	Yes	Yes	Yes	Yes
Extra grommets	N/A	Yes	Yes	N/A	Yes
Carry case	Yes	Yes	Yes	Yes	Yes
Cable length	3m	1.3m	N/A	1.2m	1.5m (braided)
Weight	250g	44g	23g	132g	14g
Warranty	1 year	1 year	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/NBCFJW6	TINYURL.COM/OEAGFOF	TINYURL.COM/O2CJV3R	TINYURL.COM/PZO7PON	TINYURL.COM/P7W7RVL

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Best power banks

	1 PC ADVISOR GOLD	2 PC ADVISOR RECOMMENDED	3 PC ADVISOR RECOMMENDED	4 PC ADVISOR RECOMMENDED	5
	Zendure A2	Anker Astro Mini	Intocircuit Power Castle	Intocircuit PowerMini	Lumsing 10400mAh
Price	£33 inc VAT	£13 inc VAT	£22 inc VAT	£10 inc VAT	£17 inc VAT
Website	Zendure.com	Ianker.com	Hisgadget.com	Hisgadget.com	Lumsing.com
Launch date	May 14	Apr 13	Mar 13	Jul 14	Apr 14
Overall rating	★★★★½	★★★★½	★★★★½	★★★★☆	★★★★½
Capacity	6000mAh	3200mAh	11200mAh	3000mAh	10400mAh
Input	1x 7.5W Micro-USB	1x 4W Micro-USB	1x 5W Micro-USB	1x 5W Micro-USB	1x 7.5W Micro-USB
Outputs	1x 10.5W USB	1x 5W USB	1x 10.5W USB, 1x 5W USB	1x 5W USB	1x 10.5W USB, 1x 5W USB
Auto-on/-off	Yes	No	Auto-on	No	No
Passthrough charging	Yes	No	Yes	No	No
Status indicator	4 LEDs	No	LCD screen	3 LEDs	4 LEDs
LED flashlight	No	No	Yes	Yes	No
Carry case	Yes	Yes	Yes	Yes	Yes
Dimensions	93x48x23mm	92x23x23mm	110x71x22mm	110x20x20mm	138x59x20mm
Weight	137g	80g	280g	118g	354g
Warranty	1 year	18 months	1 year	1 year	1 year
FULL REVIEW	TINYURL.COM/NGCNO5F	TINYURL.COM/PZHUHJO	TINYURL.COM/P5M9NKE	TINYURL.COM/KWONE54	TINYURL.COM/Q9DYG5G

Best desktop chargers

	1 PC ADVISOR RECOMMENDED	2	3	4	5
	iClever USB Travel Charger	Zendure Turbo Charger	Olixar Smart IC Charger	Inateck USB Charger	Lumsing 5-Port Charger
Price	£20 inc VAT	£25 inc VAT	£34 inc VAT	£15 inc VAT	£8 inc VAT
Website	Hisgadget.com	Zendure.com	Mobilefun.co.uk	Inateck.com	Lumsing.com
Launch date	Oct 14	May 14	Feb 15	Feb 14	Apr 14
Overall rating	★★★★☆	★★★★☆	★★★★☆	★★★★☆	★★★☆☆
Max output	50W	40W	50W	35W	30W
Outputs: USB 1	12W USB	12W USB	12.5W USB	10.5W USB	10W USB
USB 2	12W USB	12W USB	12.5W USB	10.5W USB	10W USB
USB 3	12W USB	12W USB	12.5W USB	5W USB	10W USB
USB 4	12W USB	12W USB	12.5W USB	5W USB	5W USB
USB 5	12W USB	12W USB	12.5W USB	5W USB	5W USB
USB 6	12W USB	N/A	12.5W USB	N/A	N/A
Colours available	Black	Black, white	White	Black	Black
Dimensions	100x69x27mm	97x60x27mm	100x69x26mm	100x55x20mm	136x68x30mm
Weight	180g	166g	189g	340g	422g
Warranty	1 year	1 year	2 years	1 year	1 year
FULL REVIEW	TINYURL.COM/MPA4DWC	TINYURL.COM/NKYNJ7P	TINYURL.COM/OCZXK93	TINYURL.COM/KBXUHDF	TINYURL.COM/LK22OGY

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MATT EGAN



Spend, spend, spend

Following Apple's recent and rather underwhelming WWDC keynote, the aspect that most excited one of my *Macworld* colleagues was the imminent introduction of Apple Pay to the UK. I suspect he isn't alone – not least because I too felt the frisson of excitement at the idea of being able to wave a phone at a barista in order to purchase an over priced coffee. That Apple has massively trumped Google with its race to contactless payment feels like a big win.

But why? It is undeniably convenient to be able to pay in a contactless way. And the tech is futuristic and sexy. But it is kind of weird that the ability to spend money quickly now constitutes an exciting feature. Not least because the ability to spend money we don't have is what got us in all that nasty trouble in 2008.

I'm not complaining. When I was a student and the bank handed me a credit card in lieu of an overdraft, I was only too happy to spend its money on CDs from Our Price (different times, reader, different times). It took me a decade to pay off all the debt I accrued from such fripperies, but I didn't have to take the rope when the bank offered it. Indeed, I happily threw my head in the noose.

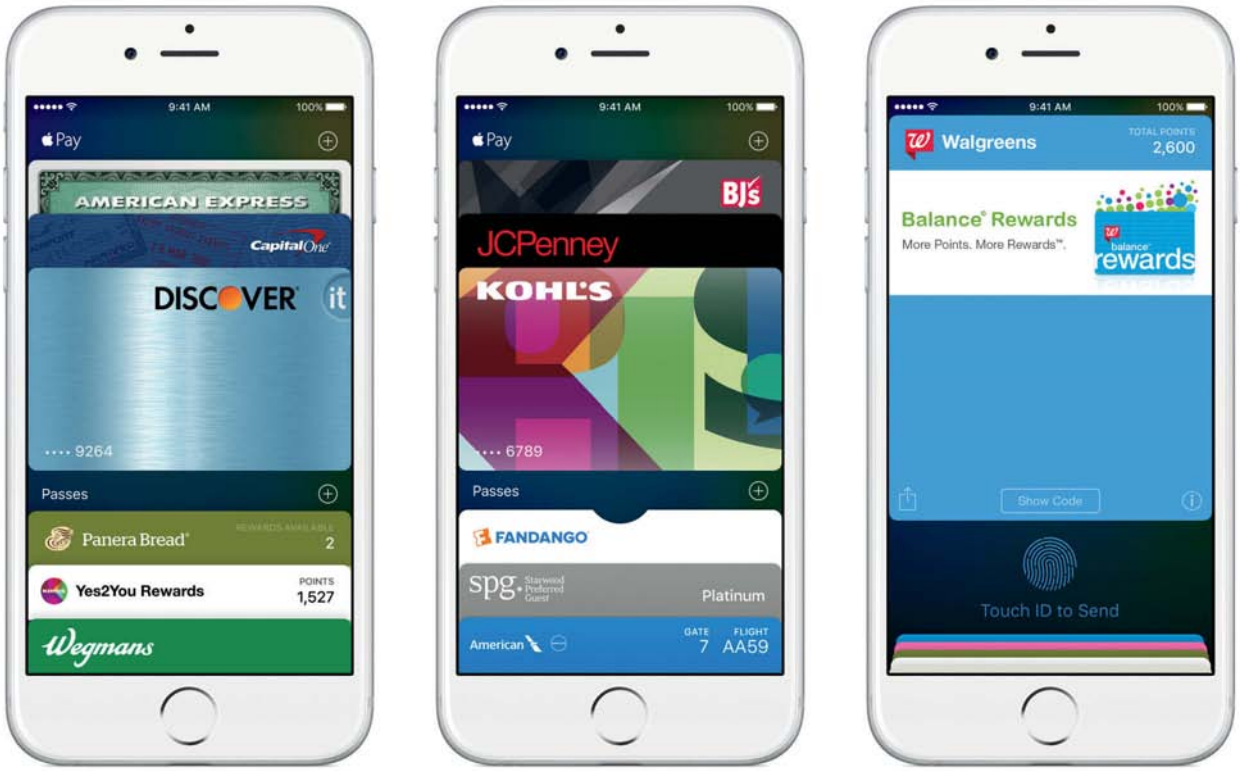
Of course, we now know that buying things on credit is a bad thing, by and large. Especially when entire nations are buying things they can't afford, from other nations, who are making a mint from manufacturing (and then lending them the money back to buy more stuff). On a very broad level, the credit crunch was caused by the West borrowing money from the East in order to pay for products manufactured in the East.

The trouble is that tech companies are now offering us the ability to borrow more money, more quickly, to pay for more stuff. (If you are spending your overdraft in Starbucks, you are borrowing money for stuff, trust me.) What's more, the hardware on which we are making those purchases is – yes – manufactured in the Far East. That's right, in the countries from whom we are borrowing the money, in the end.

I'm not being a killjoy. Or, at least, I am not only being a killjoy. I like a pointless purchase as much as the next man. And I am certainly not blaming Apple or any tech company for giving the customer what we want.

But it does concern me that in this time of peak smartphone, we are being sold new devices on the basis that they enable us to buy more stuff, more quickly. It's a more efficient way of getting ourselves into further credit crunchery, and we are welcoming it – nay demanding it – with one voice.

> **"Tech companies are now offering us the ability to borrow more money, more quickly, to pay for more stuff"**



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